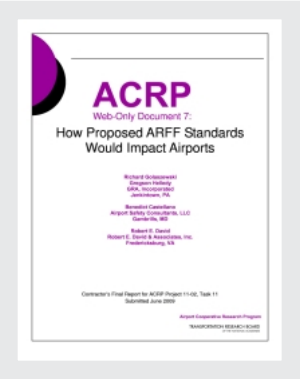

How Proposed ARFF Standards Would Impact Airports

DETAILS

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EXECUTIVE SUMMARY

BACKGROUND

Section 311 of H.R. 915 EH***, FAA Reauthorization Act of 2009*** calls for more closely aligning airport rescue and fire fighting (ARFF) regulations under Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports, with voluntary consensus standards. The airport community has noted that these requirements could impact airport costs and air service levels at airports, necessitating research on these issues. Thus, the Airport Cooperative Research Program (ACRP) requested this analysis of the potential impacts on airports from adopting new ARFF standards. This report provides technical information and analyses that can be used by others, in conjunction with information from other sources, in formulating policies, regulations, and procedures related to this issue.

The analyses in this report compare existing ARFF standards with those of two organizations that also promulgate ARFF standards, the International Civil Aviation Organization (ICAO) and the National Fire Protection Association (NFPA). These standards would have to be incorporated into revised ARFF regulations, which would likely take place under the notice and comment provisions that apply to agency rulemaking. This report provides information that can be used to assess the potential impacts on airports from aligning FAA regulations with these standards. The analysis does not examine impacts of extending ARFF to airports that are not currently required to hold Part 139 certificates.

The analysis includes a review of eleven years of aircraft accident data covering the types of operations governed by Part 139. This research examined whether revised ARFF standards would have made a difference in the number of fatalities in these accidents. In addition, a number of Part 139 airports were interviewed to assess the impacts of revised ARFF standards on airport costs.

There are 562 airports certified under Part 139 in the United States (as of Feb. 9, 2009). Figure 1 shows the classes FAA uses to define airports based on the seating capacity and nature of service. This study reports on the incremental costs of adopting ICAO and/or NFPA standards over the current levels of ARFF provided at the 476 airports certified Class I, II and III Part 139 airports. Class IV airports were excluded because they only have occasional operations by unscheduled air carriers using aircraft with 31 or more passenger seats.

Figure 1: Numbers of Airports by Class

Airport Class	Scheduled Passenger Operations	Non-Scheduled Passenger Operations	Numbers of Airports
I	10 or more	31 or more	377
II	10 or more but less than 31	31 or more	57
III	10 or more but less than 31	Less than 30	42
IV	N/A	31 or more	86

COMPARISON OF PART 139 WITH ICAO AND NFPA STANDARDS

Under the statutory provisions of Title 49, United States Code 44706, the FAA is authorized to certificate airports receiving scheduled air carrier service with aircraft having more than nine passenger seats and unscheduled air carrier service with aircraft having more than 30 passenger seats. 14 CFR Part 139 is the regulation that sets forth the requirements for airport certification. It is not applicable to heliports or to airports that: 1) are served by large all-cargo aircraft only, 2) are in Alaska and are served by air carrier aircraft with less than 31 passenger seats, or 3) do not have air carrier service that uses aircraft with more than nine passenger seats.

ICAO Annex 14, paragraph 1.2.2 states: "the specifications, unless otherwise indicated in a particular context, shall apply to all aerodromes open to public use in accordance with the requirements of Article 15 of the (Chicago) Convention." However, Annex 14 standards apply to countries and are only applicable to airport operators if their country adopts the Annex 14 standard. In addition to standards, ICAO also provides "Recommendations." Countries may adopt or not adopt ICAO standards and recommendations.

NFPA standards are written for airports of all sizes that have all-cargo and general aviation operations, as well as air carrier passenger operations. NFPA standards apply to airport operators if the state where the airport is located or the airport operator has adopted those standards. NFPA 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports (2009 Edition), is the principal standard governing ARFF, although there are a number of other NFPA standards that affect airports and airport operations.

The FAA and the NFPA have worked together to adopt common standards whenever possible; however, there are areas where the FAA and NFPA differ significantly. One example is the requirement in Part 139, which deals with aircraft rescue and firefighting and NFPA 403. Section 139.319 (h) requires an airport operator to show that its aircraft rescue and fire fighting vehicles can respond to the midpoint of the farthest air carrier runway in three minutes for the first vehicle and four minutes for all other required vehicles. NFPA requires the first vehicle to reach any point on the operational runway in two minutes or less (NFPA 403, paragraph 9.1.3 (2009 Edition)).

ICAO also has a response time standard, which requires airports to demonstrate that the first ARFF vehicle can reach anywhere on the runway within three minutes.

Response time limits are very important in determining the numbers and locations of fire stations required at an airport and therefore the required numbers of ARFF vehicles and staffing.

In addition to ARFF response times and locations from which these apply, FAA, ICAO and NFPA also have standards for the minimum numbers of ARFF vehicles and rules for determining the required numbers of staff. As shown in Figure 2, these are affected by the sizes of aircraft typically serving the airport, and each entity has a classification system for the levels of ARFF required. (While FAA uses classes to define the types of aircraft in terms of seating capacity and type of service, it uses an "index" to further subdivide the ARFF categories, based on the physical dimensions of the aircraft.)

Figure 2: FAA ARFF Index Comparison to ICAO and NFPA

FAA Airport Index	Aircraft Length	ICAO Airport Category	Aircraft Length up to but not Including	Width up to but not including	NFPA Airport Category	Aircraft Length up to but not Including	Width up to but not including	**Sample Aircraft**
A	<90'	4	78' 24m	13.1' 4m	4	78'	13.0'	EMB120
A	<90'	5	91' 28m	13.1' 4m	5	90'	13.0'	CRJ-200; Saab 340
B	90' <126'	6	127' 39m	16.4' 5m	6	126'	16.4'	DC-9, A320
C	126' <159'	7	160' 49m	16.4' 5m	7	160'	16.4'	B757-200; B767-200ER
D	159' <200'	8	200' 61m	22.9' 7m	8	200'	23.0'	A300; B757-300
E	>200'	9	249' 76m	22.9' 7m	9	250'	23.0'	A340-600; B777
E	>200'	10	295' 90m	26.2' 8m	10	295'	25.0'	AN-225, A380

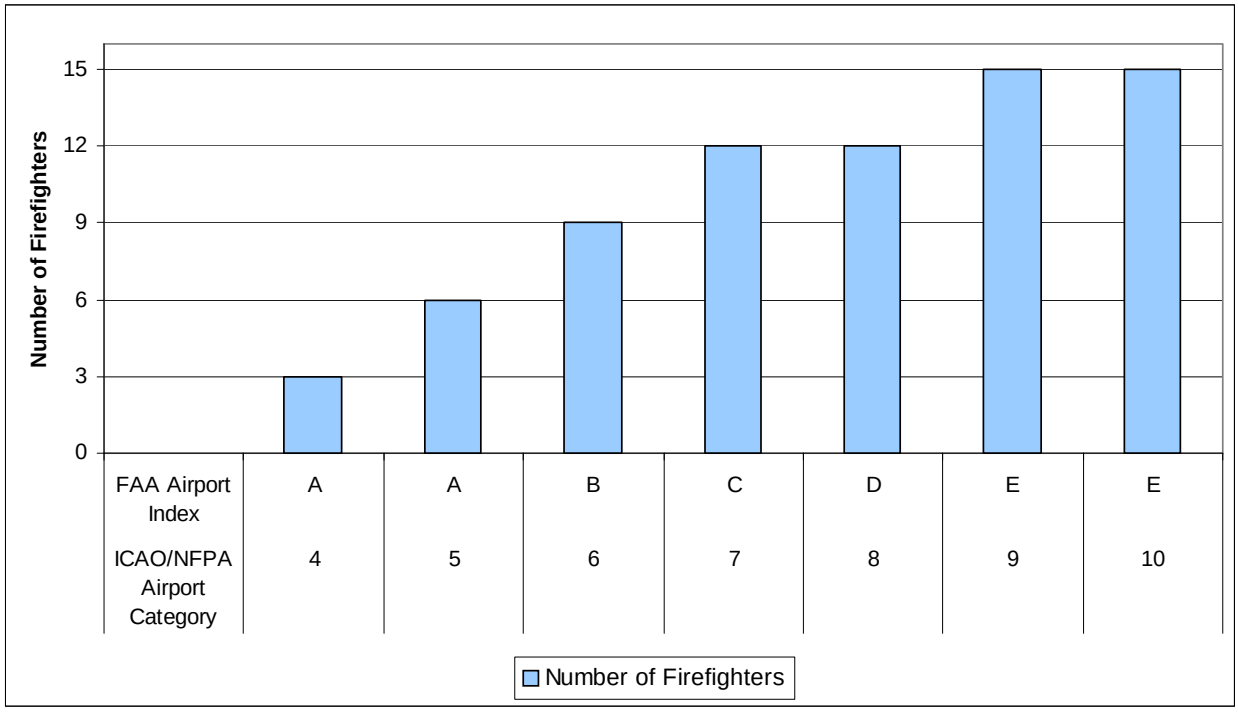
Figure 3 shows the minimum numbers of ARFF vehicles required under FAA Part 139, ICAO and NFPA standards. As can be seen these are broadly comparable, but response time standards generally require that an airport certified under Part 139 will have to add vehicles and fire stations to meet NFPA and ICAO standards.

Figure 3: Minimum Number of ARFF Vehicles Required

ICAO/NFPA Airport Category	FAA Airport Index	Vehicles			Example Aircraft
		ICAO	FAA	NFPA	
4	A	1	1	1	DHC-8-100
5	A	1	1	2	ATR-72
6	B	2	1 – 2	2	B-737-300; Emb-145
7	C	2	2 – 3	3	B-757
8	D	3	3	3	A300; B-767-300
9	E	3	3	4	B-747-200; A340-400
10	E	3		4	AN-225; A380

NFPA also has minimum staffing requirements based on the class of airport. FAA and ICAO do not use a minimum number of firefighters but require that a "sufficient number" of trained personnel be present, which in turn is determined by the number of fire stations and vehicles required to meet response time standards. Figure 4 shows an alignment of the FAA, ICAO and NFPA airport categories along with the staffing required by NFPA.

Figure 4: NFPA 403 Minimum Number of Firefighters per Shift



Note: FAA and ICAO do not have an explicit minimum staffing requirement.

SAFETY ANALYSIS

Fatal air carrier accidents over an eleven-year period (January 1, 1997 to December 31, 2007) were reviewed to determine if revised ARFF standards would have made a difference in the number of fatalities. The review included all fatal accidents in the United States for Part 121 scheduled or non-scheduled operations and Part 135 scheduled air taxi or commuter operations. There were 23 Part 121 accidents and 13 scheduled Part 135 accidents that occurred during the review period. The most recent reviewed accident occurred on July 10, 2007.

Part 121 Accidents

Eleven Part 121 aircraft accidents occurred far from airport property, according to the NTSB reports. As such, these accidents were not considered to be relevant from an ARFF perspective. Of the remaining 12 Part 121 aircraft accidents, nine were not considered to be relevant to an ARFF response even though they occurred on airport property. These included seven accidents involving fatalities to ground personnel, such as someone walking into a propeller, someone getting sucked into a jet engine or a collision between ground equipment and parked aircraft.

The three remaining Part 121 accidents required a review of pertinent sections of the full NTSB report to determine if different ARFF standards might have had any impact on the outcome in terms of reducing the severity of injuries or in preventing deaths:

- **Little Rock, Arkansas, June 1, 1999—** An MD-80 aircraft carrying 139 passengers and a crew of six overran Runway 4R while landing during a rainstorm. In its analysis, the NTSB determined that the accident was potentially survivable for two of the passengers that died; but that, even with a shorter ARFF response time, the lives of these two passengers would not have been saved if emergency responders had arrived on the scene earlier. In one case, the passenger would have had to evacuate the aircraft immediately and, in the second case, the ARRF response team would have had to enter the aircraft instead of first suppressing the fire.

- **Charlotte, North Carolina, January 8, 2003—** A Beech 1900 crashed into a maintenance hangar shortly after takeoff from Runway 18R at Charlotte-Douglas International Airport. The aircraft was destroyed by impact and post crash fire. It was determined that all 21 people on board the aircraft died from "multiple blunt injuries due to an airplane crash."

- **Lexington, Kentucky, August 27, 2006—** A CRJ-100 took off on the wrong runway, ran off the end of the runway and impacted the perimeter fence, trees

and terrain. The accident site was located off airport property approximately 1,800 feet from the departure end of the runway. Of the 50 people on board only the first officer survived. There were several passengers who survived the crash but died due to smoke inhalation or thermal injuries. The NTSB found it was not possible to determine how long these passengers survived, but noted that all of the passengers were found close to their seats.

Scheduled Part 135 Accidents

In 2004, Part 139 was amended to require airports with scheduled operations by aircraft having more than nine passenger seats to be certificated. This change did not apply to airports located in the state of Alaska. Of the 13 accidents involving scheduled Part 135 operations, 10 occurred in Alaska. The site of these accidents varied from 300 yards from the airport to 49 miles from the airport.

Of the three accidents that occurred in the "lower 48" only two occurred on the airport and neither one of these airports was required to be certificated under Part 139. The autopsies from one of these two accidents (which occurred in 2000) revealed that four of the fatalities resulted from asphyxia from smoke inhalation and/or thermal injuries. However, even with the change to Part 139 in 2004, this operation would not have been affected since the aircraft had only nine passenger seats and, therefore, the aircraft was not required to operate only at certificated airports.

Summary of Safety Analysis

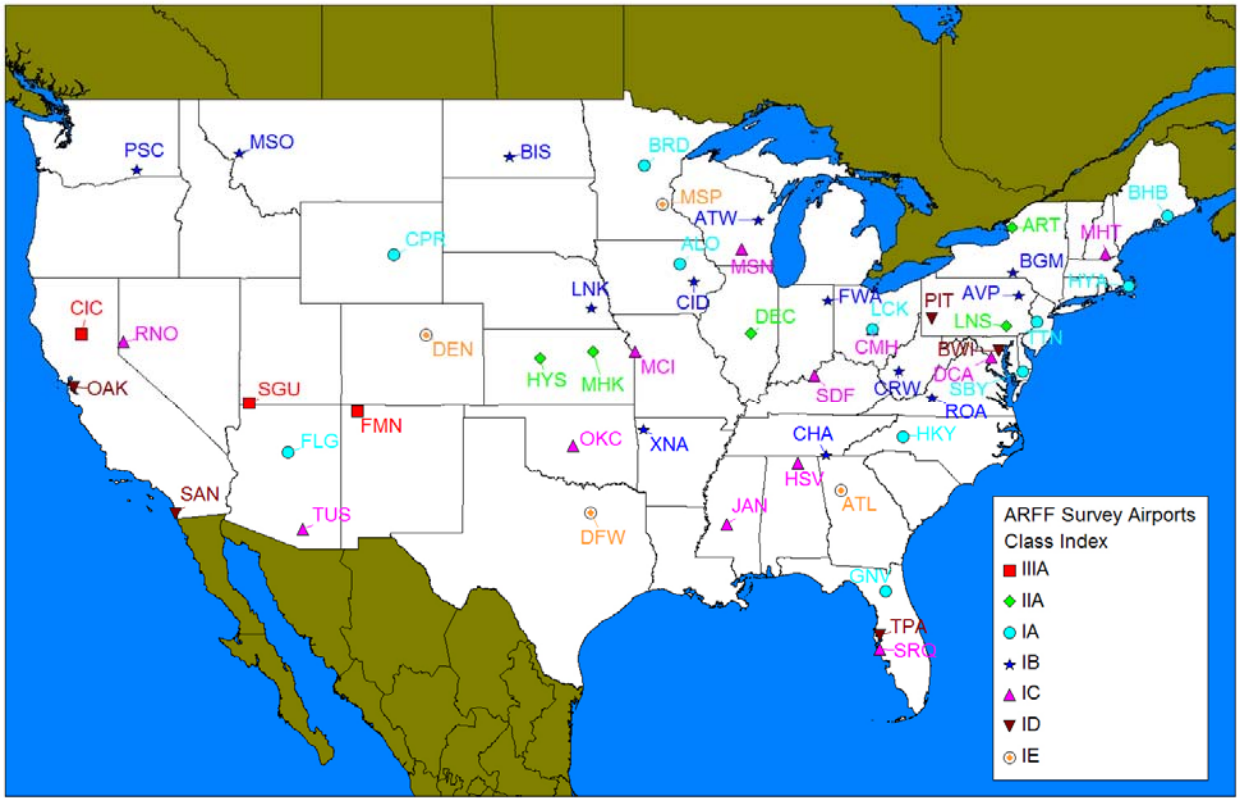
In the Lexington, KY accident, the NTSB indicated that some people on board died from thermal injuries and/or smoke inhalation. However, it is not clear that the adoption of NFPA 403 standards or ICAO Annex 14 standards would have resulted in their survival. The accident site was located off airport property and outside NFPA's prescribed Rapid Response Area. Even if the NFPA standards were in effect, the survivability of this accident would not have changed because there still would have been a substantial period of time before ARFF could have reached the aircraft. In its analysis of the Little Rock accident, the NTSB found that the accident was survivable for two of the passengers; however, it also determined that an improved ARFF response time would not have resulted in these two lives being saved.

It is difficult to suggest what might happen in terms of future accidents. With the very small number of accidents in passenger air carrier operations and the multiplicity of causes and outcomes, it is not possible to reach a conclusion from past accidents about how improved ARFF response times and capabilities would reduce accident mortality. However, the review of accidents described above suggests that enhanced ARFF standards may have made a difference in the outcome for at most one individual.

COST ANALYSIS APPROACH

The potential costs of adopting ICAO or NFPA ARFF standards were assessed using an interview program with a representative group of Part 139 Class I, II and III airports. These were selected to provide a geographic as well as a size distribution of airports. A total of 53 interviews were completed at the airports shown in Figure 5. The interviews were conducted with airport managers and/or their designees, which included staff from operations, fire chiefs and other knowledgeable individuals.

Figure 5: Airports Interviewed



The analysis focused on the key costs of moving to the ICAO and NFPA standards. These included the additional staffing, firehouses, ARFF vehicles and other equipment needed to meet the ICAO and NFPA response time standards. The analysis also considered the minimum staffing requirements of NFPA, and the training and other costs that result from increased staffing. It also identifies those costs that could not be quantified. Figure 6 shows the number of airports interviewed in each Part 139 Class/Index group. As can be seen about 11 percent of the 476 airports were interviewed. Class IIA and IIIA airports are put into one group in the cost analysis below, which summarizes these cost impacts and expands them to the 476 Part 139 airports.

Figure 6: Number and Percentage of Airports and Interviews

Airport Class	ARFF Index	Number of Airports	Percent of Airports	Airport Interviews Completed	Percent Interviews Completed
Total		**476**	**100.0%**	**53**	**11.1%**
Class III	A	42	8.8%	3	7.1%
Class II	A	57	12.0%	5	8.8%
Class I	A	131	27.5%	11	8.4%
Class I	B	111	23.3%	13	11.7%
Class I	C	78	16.4%	12	15.4%
Class I	D	33	6.9%	5	15.2%
Class I	E	24	5.0%	4	16.7%

Figure 7 shows the number of firefighters and ARFF vehicles for each airport group as reported in the interviews, and provides an indication of the scale of ARFF operations at the different airport classes. In addition, the figure also shows the average number of firefighters for airports within each group. As expected, the larger airports have the largest numbers of firefighters and ARFF vehicles. These data are expanded to cover the 476 Class I, II, and III Part 139 airports. While the average airport has 26 firefighters and three vehicles, Class IA airports have 10 firefighters and two vehicles, and Class IE airports have 115 firefighters and seven vehicles.

Figure 7: Average and Total Firefighters and Vehicles

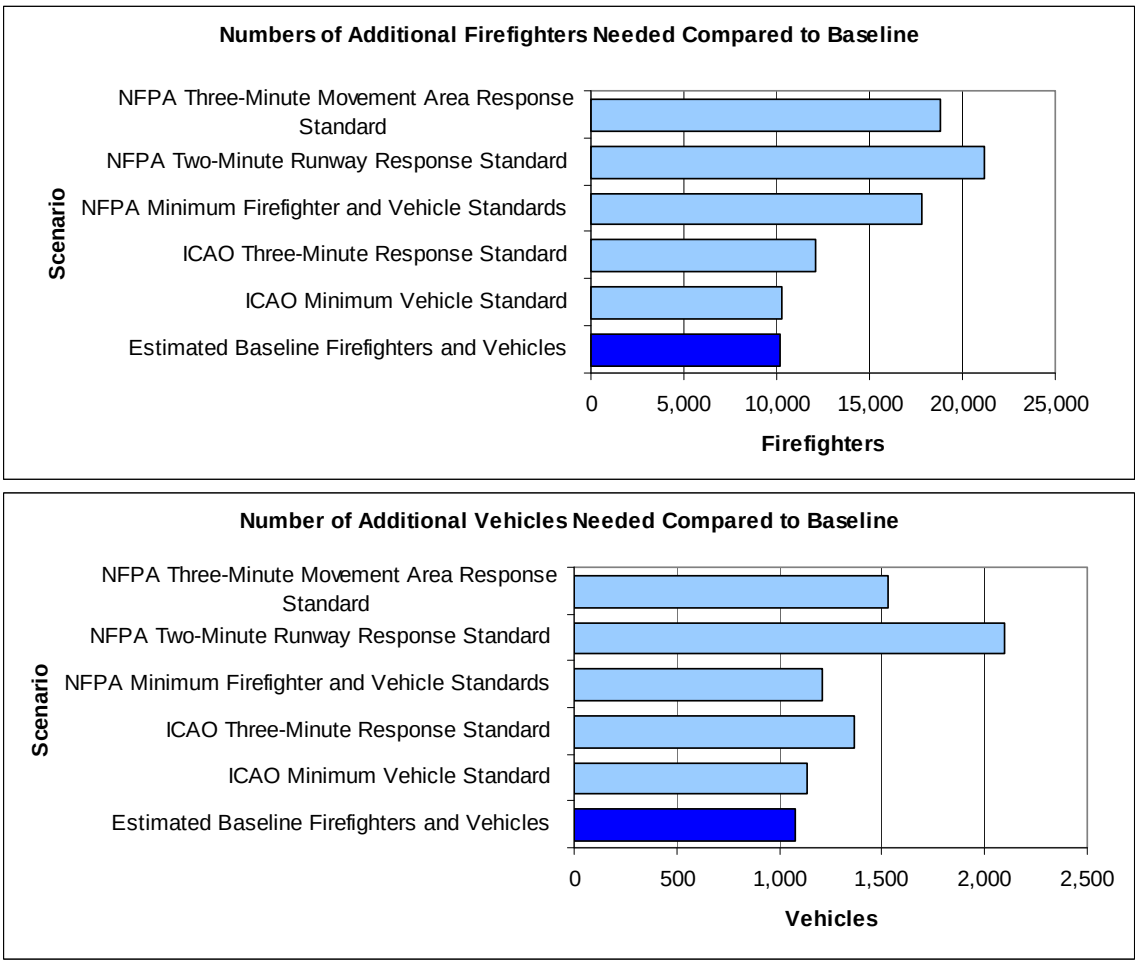
Reported Firefighters and ARFF Vehicles and Estimated Total for Part 139 Airports							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Firefighters From Interviews	60	103	193	256	215	460	1,287
Number Of Airports Responding	8	10	13	9	5	4	49
Average Number of Firefighters	8	10	15	28	43	115	26
Estimated Firefighters for 476 Airports	**743**	**1,349**	**1,648**	**2,219**	**1,419**	**2,760**	**10,137**
Number of ARFF Vehicles From Interviews	10	17	22	38	22	29	138
Number Of Airports Responding	8	11	13	12	5	4	53
Average Number of ARFF Vehicles	1	2	2	3	4	7	3
Estimated ARFF Vehicles for 476 Airports	**124**	**202**	**188**	**247**	**145**	**174**	**1,080**

ESTIMATED COST IMPACTS

The estimated cost impacts on airports from adoption of ICAO and /or NFPA standards were developed using information gathered during the airport interviews. While information on the full range of potential costs was gathered, the results presented below focus on the major cost categories, including the construction of new ARFF stations, the acquisition of new ARFF vehicles and the additional firefighters that would be needed to meet minimum personnel requirements and to staff the additional fire stations and ARFF vehicles required to comply with response time standards. The

baseline against which costs are measured is the current ARFF capability at the airport, which may exceed the minimum level required by Part 139. Figure 8 shows the changes in numbers of firefighters and ARFF vehicles under the ICAO and NFPA standards. The estimates for the runway response time requirements also include the staffing and vehicles added to meet minimum ICAO and NFPA requirements. The NFPA two-minute runway response requirement would double the number of firefighters and vehicles of the 476 airports.

Figure 8: Summary of Baseline Firefighters and Vehicles Required to Meet ICAO and NFPA Standards at 476 Airports



The NFPA two-minute runway response requirement could more than double the number of firefighters and ARFF vehicles at the 476 Part 139 airports considered in this study.

Figure 9 summarizes the cost impacts of the ICAO and NFPA standards, reporting the increase in total and average costs per airport for each class. As can be seen, NFPA standards have a higher total cost and average cost per airport than ICAO standards. The two-minute demonstrated response time to the runway end has the higher costs of the two NFPA response standards, with an annualized cost of approximately $1.03 billion. The ICAO minimum vehicle requirements have a relatively small impact and affect only Class IB airports, while the estimated costs of the NFPA minimum vehicle and staffing requirements are much larger and affect all airport groups. In general, the average cost per airport is higher for those groups with a larger baseline ARFF presence. Firefighter salaries represent the largest annual cost impact.

Figure 9: Summary Cost Impacts

Summary of Annual Coat Impacts of ICAO and NFPA Standards ($ millions)					
Total Annual Operating and Depreciation Costs					
Airport Class	**ICAO**		**NFPA**		
	Vehicle Minimum	Three-Minute	Staff/Vehicle Minimum	Two-Minute	Three-Minute
IIIA/IIA	$0.0	$14.0	$21.6	$40.8	$15.7
IA	$0.0	$9.4	$116.4	$148.9	$132.9
IB	$16.5	$57.8	$216.0	$260.8	$232.2
IC	$0.0	$69.3	$150.2	$296.3	$198.6
ID	$0.0	$25.6	$46.5	$95.5	$49.2
IE	$0.0	$56.7	$17.6	$191.6	$119.3
All	**$16.5**	**$232.8**	**$568.3**	**$1,033.9**	**$747.8**
Average Annual Operating and Depreciation Costs					
Airport Class	**ICAO**		**NFPA**		
	Vehicle Minimum	Three-Minute	Staff/Vehicle Minimum	Two-Minute	Three-Minute
IIIA/IIA	$0.0	$0.1	$0.2	$0.4	$0.2
IA	$0.0	$0.1	$0.9	$1.1	$1.0
IB	$0.1	$0.5	$1.9	$2.3	$2.1
IC	$0.0	$0.9	$1.9	$3.8	$2.5
ID	$0.0	$0.8	$1.4	$2.9	$1.5
IE	$0.0	$2.4	$0.7	$8.0	$5.0
All	**$0.0**	**$0.5**	**$1.2**	**$2.2**	**$1.6**

Note: the costs of minimum vehicle and staff requirements are included in the response time estimates.

The annual recurring costs of the NFPA two-minute response standard are estimated to total $1.0 billion, the majority of which is the salaries for additional firefighters. This includes meeting the NFPA minimum vehicle and firefighter requirements.

Data on operating and annualized investment costs were developed for each airport using financial data reported by airports to FAA. This was used to calculate the cost per enplaned passenger for each airport group. Figure 10 shows the current cost per enplaned passenger for each airport group and the increase in costs in both absolute and percentage terms for both the minimum vehicles requirement and the three-minute runway response standard. As noted above, the ICAO minimum vehicles requirement only affects Class IB airports, which would face a 1.5 percent increase in costs per enplaned passenger. The requirement to demonstrate a three-minute response to the farthest runway end would increase the cost per enplaned passenger for all airport groups. The amount of the increase ($8.83) and the percentage increase (13 percent) is largest at Class IIA and IIIA airports.

Figure 10: Cost Per Enplaned Passenger Under ICAO Standards

Annual Cost per Enplaned Passenger						
Class/Index	ICAO Vehicle Minimum			ICAO Three-Minute		
	Current	Increase	Percent Increase	Current	Increase	Percent Increase
IIIA/IIA	$68.24	$0.00	0.0%	$69.74	$8.87	13.0%
IA	$88.73	$0.00	0.0%	$88.73	$1.66	1.9%
IB	$35.55	$0.52	1.5%	$34.48	$1.81	5.1%
IC	$26.38	$0.00	0.0%	$26.38	$0.34	1.3%
ID	$24.07	$0.00	0.0%	$25.99	$0.10	0.4%
IE	$19.15	$0.00	0.0%	$19.15	$0.08	0.4%

The current cost by group can differ based on the number of airports responding.

Figure 11 shows the change in costs per enplaned passenger from the NFPA standards. The NFPA minimum staffing and vehicle requirements result in an increase in costs per enplaned passenger of approximately 20 percent at Class IA, IB, IIA and IIIA airports. The airport is required to demonstrate that the first vehicle can reach the farthest runway end within two minutes during good visibility and surface conditions. The impacts of this two-minute response time combined with the minimum staffing and vehicles requirements would result in a 40 percent cost increase at Class IIA and IIIA airports, and an increase of over 20 percent at Class IA and IB airports. The estimated cost differences per enplaned passenger for the NFPA three-minute response time standards for the taxiways, ramp and apron are lower than for the two-minute standard at Class ID and IE airports. The percentage changes for the three-minute standard are approximately the same as for the two-minute standard at Class IA, IB and IC airports. However, the cost differences at Class IIA and IIIA airports, where the costs of the three-minute standard are less than the costs for the minimum staffing and vehicles, are due to a change in number of airports responding.

Figure 11: Cost Per Enplaned Passenger Under NFPA Standards

Annual Cost per Enplaned Passenger									
Class/Index	NFPA Staff/Vehicle Minimum			NFPA Two-Minute			NFPA Three-Minute		
	Current	Increase	Percent Increase	Current	Increase	Percent Increase	Current	Increase	Percent Increase
IIIA/IIA	$68.24	$13.67	20.0%	$69.74	$27.72	39.7%	$69.74	$10.64	15.2%
IA	$88.73	$20.58	23.2%	$88.73	$26.33	29.7%	$88.73	$23.49	26.5%
IB	$35.55	$6.77	19.1%	$34.48	$7.89	22.9%	$35.55	$7.28	20.5%
IC	$26.38	$0.73	2.8%	$26.38	$1.44	5.4%	$26.38	$0.96	3.6%
ID	$24.07	$0.17	0.7%	$25.99	$0.37	1.4%	$25.99	$0.19	0.7%
IE	$19.15	$0.03	0.1%	$19.15	$0.28	1.5%	$19.15	$0.18	0.9%

The current cost by group can differ based on the number of airports responding.

The cost increases for smaller airports can be significant. As an example, the minimum ARFF vehicle and firefighter requirements are estimated to raise the cost per enplaned passenger by over $10.00 at Class I, II and III A airports.

It was not possible to estimate all costs; the most significant of these is the requirement to make the entire rapid response area (RRA) accessible to ARFF vehicles within 2½ minutes. Although the airport may own the land beyond the FAA-required runway safety area (RSA), it is often a major undertaking to make this area accessible to ARFF vehicles. This could entail the construction of access roads, moving fences, major earth moving and fill, and other improvements. In addition, even after these areas were made accessible, the airport still may have to relocate existing ARFF stations or build new ones to meet the 2½ minute response times in the RRA recommended by NFPA.

SUMMARY

Figure 12 summarizes the estimated investment cost impacts for additional fire stations and vehicles, and the annual operating and depreciation cost impacts of the ICAO and NFPA standards for the 476 Class I, II, and III airports. While the minimum vehicle (ICAO and NFPA) and firefighter standards would have relatively low initial costs, the annual operating and depreciation costs of the NFPA minimum vehicle and firefighter standard are $568.3 million. The ICAO three-minute runway response has initial costs of $884.5 million and recurring costs (primarily for additional firefighters) of $232.8 million (including the annualized initial costs). The NFPA two-minute runway response standard has the highest costs, with initial costs of $2.9 billion and annual operating and depreciation costs of $1.0 billion. The NFPA three-minute response to taxiways, ramps and aprons (maneuvering area) has initial costs of $1.2 billion and annual operating and maintenance costs of $747.8 million.

Figure 12: Summary Cost Impacts of ICAO and NFPA Standards at 476 Airports ($millions)

Standard	Total Initial Costs	Annual Operating and Depreciation Costs
ICAO Minimum Vehicles	$36.3	$16.5
ICAO Three-Minute Runway Response	$884.5	$232.8
NFPA Minimum Firefighters and Vehicles	$143.5	$568.3
NFPA Two-Minute Runway Response	$2,858.1	$1,033.9
NFPA Three Minute Maneuvering Area Response	$1,220.2	$747.8

Note: Response standard estimates include meeting minimum standards for vehicles and firefighters, as appropriate.

- **The NFPA two-minute runway response requirement is estimated to increase airport investment costs for constructing and equipping fire stations and acquiring ARFF vehicles by $2.9 billion.**
- **The NFPA three-minute response to anywhere on the airport maneuvering area has estimated investment costs of $1.2 billion and annual recurring costs of $747.8 million.**
- **The ICAO three-minute response standard has estimated investment costs of $884.5 million and annual recurring costs of $232.8 million.**

In summary, it must be noted that the cost estimates contained in the report are based on the stated differences in the FAA, ICAO, and NFPA standards. The actual increase in ARFF costs experienced by any airport would be based on the specific changes to Part 139, because FAA has the latitude to adopt all, some or none of the other industry standards. In addition, these changes would be subject to the normal requirements of agency rule making.

SECTION 1
INTRODUCTION

BACKGROUND

Section 311 of H.R. 915, ***FAA Reauthorization Act of 2009*** (2-9-2009) calls for more closely aligning airport rescue and fire fighting (ARFF) regulations under Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports, with voluntary consensus standards. These standards would reduce ARFF response times by increasing the numbers of firefighters, fire stations and ARFF response vehicles at airports. The airport community has noted that these requirements could increase airport costs and air service levels at airports, necessitating research on these issues.

The analyses in this report compare existing ARFF standards with those of two organizations that also promulgate ARFF standards, the International Civil Aviation Organization (ICAO) and the National Fire Protection Association (NFPA). This report provides information that can be used to assess the potential impacts on airports from aligning FAA regulations with these standards. The analysis does not examine impacts of extending ARFF to airports that are not currently required to hold Part 139 certificates.

A working group studied this issue in 2004 and furnished a report to an Aviation Rulemaking Advisory Committee (ARAC) chartered by FAA. However, no specific proposal to change Part 139 regulations to incorporate NFPA and/or ICAO standards was made. The research conducted during this study was based on a comparison of the requirements that could ensue from the adoption of ICAO and/or NFPA standards for ARFF. These standards would have to be incorporated into revised ARFF regulations, which would likely take place under the notice and comment provisions that apply to agency rulemaking.

PROJECT SCOPE

The objectives of this research are to:

- Compare current FAA ARFF requirements to NFPA and ICAO standards,
- Provide a financial analysis of the operational costs for airports to comply with the NFPA and ICAO standards to the extent that they differ from the costs associated with the current FAA requirements, including assessments and discussions regarding:
  - Initial costs to implement or start-up these new standards
  - Continuing cost to provide these ARFF services

- Implications for cost by size of airport and cost per enplaned passenger (CPE)

- Provide a financial analysis of the infrastructure and equipment costs for airports to comply with the NFPA and ICAO standards to the extent that they differ from the costs currently incurred to meet FAA requirements, and

- Provide an analysis of the cost of NFPA and ICAO standards compared to the cost and level of safety in current FAA ARFF standards.

Section 2 of this report compares FAA, ICAO and NFPA ARFF requirements. Section 3 presents an analysis of prior accidents to assess whether increased ARFF capabilities could reduce the mortality of aircraft accidents. Section 4 provides descriptive data collected during the interviews and estimates for the major cost factors used in the analysis. The analysis did not evaluate a specific regulatory proposal to modify Part 139; however, it identified those factors that would drive ARFF cost changes. Section 5 provides estimates of the costs associated with the NFPA and ICAO standards. The data underlying the cost estimates were developed for a representative group of Class I, II and III Part 139 airports. The analyses below report the average cost impact by Part 139 airport class and ARFF index. These results are then expanded to all airports within a specific group, and are reported in terms of the total cost impact on an airport group and on the airport group's cost per enplaned passenger.

SECTION 2
COMPARISON OF FAA PART 139 CERTIFICATION WITH ICAO AND NFPA STANDARDS

INTRODUCTION

This section identifies the differences between Title 14 CFR Part 139 ARFF requirements and the ICAO Annex 14 and NFPA standards (primarily contained in NFPA 403). One of the most important differences is that FAA regulations must be specific enough so that certification, inspection and compliance monitoring can take place. NFPA and ICAO standards themselves are not binding until incorporated into a body of law or regulations. Standards and recommended practices are expected to evolve and change over time, while FAA regulations are changed via the notice and comment requirements of the Administrative Procedures Act and other guidelines.

Part 139 requirements apply to airports that have air carrier passenger service. ICAO Annex 14 and NFPA standards are written for airports of all sizes, and includes air carrier cargo and general aviation operations, as well as air carrier passenger operations. However, Annex 14 standards apply to countries and are only applicable to airport operators if their country adopts the Annex 14 standard. In addition to standards, ICAO also provides "Recommendations." Countries may adopt or not adopt, in whole or in part, ICAO standards. NFPA standards apply to airports in the United States if the state/municipality where the airport is located or the airport operator has adopted those standards.

THE FEDERAL AVIATION ADMINISTRATION'S SAFETY REGULATORY STANDARDS

In the United States, the FAA is responsible for civil aviation safety. As part of the Department of Transportation, the principal roles of FAA include:

- Regulating civil aviation to promote safety
- Encouraging and developing civil aeronautics, including new aviation technology
- Developing and operating a system of air traffic control and navigation for both civil and military aircraft
- Researching and developing the National Airspace System and civil aeronautics
- Developing and carrying out programs to control aircraft noise and other environmental effects of civil aviation
- Regulating U.S. commercial space transportation

The FAA issues and enforces regulations and minimum standards covering manufacturing, operating and maintaining aircraft, in addition to certifying airmen and airports that serve air carriers. It operates a network of air traffic control towers, approach control facilities and air route traffic control centers. It develops air traffic rules, assigns the use of airspace and controls air traffic. FAA also maintains, operates and assures the quality of air navigation and air traffic control facilities. It oversees the Airport Improvement Program (AIP) that funds certain types of airport development.

Under normal procedures, the FAA must seek public comment when proposing a new regulation or changes to an existing one. It usually does this by issuing a Notice of Proposed Rulemaking (NPRM), which contains not only the proposed regulation, but also a preamble explaining why the regulation is needed. The NPRM is published along with an economic analysis setting forth the benefits and costs of the proposed rule. Once the comment period is closed, the FAA evaluates the comments and publishes the Final Rule. The rule contains a preamble that includes a disposition of comments from the NPRM and a justification for the final rule.

As a supplement to regulations, the FAA also publishes documents known as Advisory Circulars (ACs). In general, ACs are advisory in nature but can, under certain circumstances become mandatory. For example, if an airport operator accepts an FAA grant to pay for an ARFF vehicle, then ACs that deal with the standards for ARFF vehicle design become mandatory.

In the case of airport safety, the FAA adopted Title 14 CFR Part 139, Airport Certification, in 1972. Since then, the regulation has been amended or rewritten on several occasions. The first major rewrite was in 1988 and the second in 2004. Part 139 contains specific requirements for operators of airports with air carrier passenger service. Some of these requirements concern aircraft rescue and fire fighting, and are found in Sections 139.315, 139.317 and 139.319.

INTERNATIONAL CIVIL AVIATION ORGANIZATION SAFETY STANDARDS AND STRUCTURE

The ICAO is a special agency of the United Nations linked to the Economic and Social Council. The constitution of ICAO is the Convention on International Civil Aviation, drawn up by a conference in Chicago in November and December 1944, and to which each ICAO Contracting State is a party. ICAO works in close co-operation with other organizations of the United Nations, such as the World Meteorological Organization, the International Telecommunication Union, the Universal Postal Union, the World Health Organization and the International Maritime Organization. Non-governmental organizations that participate in ICAO's work include the International Air Transport Association, the Airports Council International, the International

Federation of Air Line Pilots' Association and the International Council of Aircraft Owner and Pilot Associations.

ICAO's mandate is to ensure the safe, efficient and orderly evolution of international civil aviation. This is done through the issue of Standards and Recommended Practices (SARPs), which are adopted and incorporated as Annexes to the Convention on International Civil Aviation. The principal body concerned with the development of technical Standards and other provisions is the Air Navigation Commission. Its primary role is to advise the ICAO council on air navigation issues. It is composed of fifteen experts with appropriate qualifications and experience in various fields of aviation. Its members are nominated by Contracting States and are appointed by the Council. They are expected to function as independent experts and not as representatives of their States.

A Standard, in ICAO's terms, is defined as any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention. In the event that compliance is not possible, notification to the Council is compulsory under Article 38 of the Convention.

A Recommended Practice is any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavor to conform in accordance with the Convention. States are invited to inform the Council of non-compliance with recommended practices.

SARPs are formulated in broad terms and restricted to essential requirements. For complex systems such as communications equipment, SARPs material is constructed in two sections: Core SARPs (material of a fundamental regulatory nature contained within the main body of the Annexes) and detailed technical specifications (placed either in Appendices to Annexes or in manuals). Airport SARPs are contained in Annex 14.

State non-compliances with SARPs are published in Supplements to Annexes. It is important to recognize that, while the signatory State is bound under the Convention to abide by the Standards whenever possible, there may be reasons why the State is not able to do so. In such cases the State files a difference with ICAO. Individual airlines, manufacturers or airport operators do not comply with ICAO SARPs directly. Rather the State adopts or does not adopt the ICAO standard, and the State is responsible for ensuring compliance by its own organizations. As such, individual airport operators comply with a country's regulations (in the case of the United States, Part 139).

NATIONAL FIRE PROTECTION ASSOCIATION SAFETY STANDARDS STRUCTURE

The mission of the international nonprofit NFPA, established in 1896, is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training and education. The NFPA develops, publishes and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. These codes are developed by technical committees and are adopted and enforced throughout the world.

One of the primary documents for aircraft rescue and fire fighting standards is NFPA 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports, 2009 Edition. In addition to NFPA 403, some of the other codes adopted by NFPA that affect airports and airport operations include the following:

NFPA 402	Guide for Aircraft Rescue and Fire-Fighting Operations
NFPA 405	Standards for the Recurring Proficiency of Airport Fire Fighters
NFPA 407	Standard for Aircraft Fueling Service
NFPA 408	Standard for Aircraft Hand Portable Fire Extinguishers
NFPA 409	Standard on Aircraft Hangars
NFPA 410	Standard on Aircraft Maintenance
NFPA 412	Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Equipment
NFPA 414	Standard for Aircraft Rescue and Fire-Fighting Vehicles
NFPA 415	Standard on Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways
NFPA 418	Standard for Heliports
NFPA 422	Guide for Aircraft Accident/Incident Response Assessment
NFPA 423	Standard for Construction and Protection of Aircraft Engine Test Facilities
NFPA 424	Guide for Airport/Community Emergency Planning
NFPA 472	Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents
NFPA 473	Standard for Competencies for EMS Personnel Responding to Hazardous Materials/WMD Incidents
NFPA 1000	Standard for Fire Service Professional Qualifications Accreditation and Certification Systems
NFPA 1001	Standard for Fire Fighter Professional Qualifications
NFPA 1002	Standard for Fire Apparatus Driver/Operator Professional Qualifications
NFPA 1003	Standard for Airport Fire Fighter Professional Qualifications
NFPA 1851	Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting
NFPA 1852	Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)
NFPA 1982	Standard on Personal Alert Safety Systems (PASS)

Over the years, the FAA and the NFPA have worked together to adopt common standards whenever possible. For example, the standards and specifications in

AC 150/5220-10, Guide Specification for Aircraft Rescue and Fire Fighting Vehicles and NFPA 414, Standards for Aircraft Rescue and Fire-Fighting Vehicles are very similar to each other. However, there are also areas where the FAA and NFPA differ significantly. One example of this is the requirement in Part 139, which deals with aircraft rescue and firefighting and NFPA 403, Standards for Aircraft Rescue and Fire-Fighting Services at Airports. Section 139.319 (h) requires an airport operator to show that its aircraft rescue and fire fighting vehicles can respond to the midpoint of the farthest air carrier runway in three minutes for the first vehicle and four minutes for all other required vehicles. NFPA requires the first vehicle to reach any point on the operational runway in two minutes or less (NFPA 403, paragraph 9.1.3 (2009 Edition)).

COMPARISON OF FAA REQUIREMENTS WITH ICAO AND NFPA STANDARDS

This section identifies the differences between the 14 CFR Part 139 ARFF requirements and those set forth in the ICAO Annex 14 and NFPA 403.

Applicability

Under the statutory provisions of Title 49, United States Code 44706, the FAA is authorized to certificate airports that receive:

- Scheduled air carrier service with aircraft having more than nine passenger seats
- Unscheduled air carrier service with aircraft having more than 30 passenger seats.

14 CFR Part 139 is the regulation that sets forth the requirements for airport certification. It is not applicable to heliports or to airports that: 1) are served by large all-cargo aircraft only, 2) are in Alaska and are served by air carrier aircraft with less than 31 passenger seats, or 3) do not have air carrier service that uses aircraft with more than nine passenger seats. ARFF requirements are stated in 14 CFR sections 139.315, 139.317 and 139.19. In addition, section 139.325 deals with airport emergency planning requirements.

ICAO Annex 14, paragraph 1.2.2 states: "the specifications, unless otherwise indicated in a particular context, shall apply to all aerodromes open to public use in accordance with the requirements of Article 15 of the (Chicago) Convention." However, Annex 14 standards apply to countries and are only applicable to airport operators if their country adopts the Annex 14 standard. In addition to standards, ICAO also provides "Recommendations." Countries may adopt or not adopt ICAO standards and recommendations.

NFPA standards are written for airports of all sizes that have all-cargo and general aviation operations, as well as air carrier passenger operations. NFPA standards apply to airport operators if the state/municipality where the airport is located or the airport operator has adopted those standards. These standards are found in NFPA documents that are issued and revised periodically.

Classification of Airports

Currently, there are four classifications of air carrier airports under 14 CFR Part 139. Figure 13 shows how these apply to passenger service in terms of aircraft seating capacity for scheduled and non-scheduled operations. Effectively, a Class I airport can serve all sizes of aircraft while a Class III airport can have scheduled and unscheduled services with aircraft of 30 seats or less.

Figure 13: Part 139 Airport Classification By Seating Capacity and Service Type

Airport Class	Scheduled Passenger Operations	Non-Scheduled Passenger Operations	Numbers of Airports
I	10 or more	31 or more	377
II	10 or more but less than 31	31 or more	57
III	10 or more but less than 31	Less than 30	42
IV	N/A	31 or more	86

Due to the various sizes of aircraft serving Class I airports, they are further divided into five categories (each category is labeled as an index) for purposes of aircraft rescue and firefighting. The longest scheduled aircraft serving the airport with more than five scheduled departures a day determines the Index:

1. Index A airports serve air carrier aircraft less than 90 feet in length
2. Index B airports serve air carrier aircraft at least 90 feet in length but less than 126 feet
3. Index C airports serve air carrier aircraft at least 126 feet in length but less than 159 feet
4. Index D airports serve air carrier aircraft at least 159 feet in length but less than 200 feet
5. Index E airports serve air carrier aircraft at least 200 feet in length

Class II, III, and IV airports must meet the Index A requirements, at a minimum. However, Class III airports may substitute an alternate procedure using a firefighting response from the local community. This procedure is outlined in 139.315(e). A complete listing of Part 139 airports by index, class and state is shown in Appendix A.

The FAA requirements for determining the ARFF Index do not take into account the width of the aircraft serving the airport. The ICAO and NFPA standards consider

both aircraft length and width to determine the airport's category (equivalent to an FAA Index). Figure 14 compares the manner in which all three standards categorize airports using differences in aircraft size.

Figure 14: FAA ARFF Index Comparison to ICAO and NFPA

FAA Airport Index	Aircraft Length (ft.)	ICAO Airport Cat.	Aircraft Length (ft.) up to but not including	Width up to but not including	NFPA Airport Cat.	Aircraft Length up to but not including	Width up to but not including	**Sample Aircraft**
A	<90'	4	78' 24m	13.1' 4m	4	78'	13.0'	EMB120
A	<90'	5	91' 28m	13.1' 4m	5	90'	13.0'	CRJ-200; Saab 340
B	90' <126'	6	127' 39m	16.4' 5m	6	126'	16.4'	DC-9, A320
C	126' <159'	7	160' 49m	16.4' 5m	7	160'	16.4'	B757-200; B767-200ER
D	159' <200'	8	200' 61m	22.9' 7m	8	200'	23.0'	A300; B757-300
E	>200'	9	249' 76m	22.9' 7m	9	250'	23.0'	A340-600; B777
E	>200'	10	295' 90m	26.2' 8m	10	295'	25.0'	AN-225, A380

As part of the research, length and width data for air carrier aircraft that commonly serve U.S. airports were collected. Based upon this review, it appears that the only airports that may be affected by considering aircraft width in addition to length are those Index B and C airports being served by the Airbus 310. This aircraft is out of production and Federal Express, an all cargo carrier, is the only airline in the United States that operates the Airbus 310. Consequently, it does not appear that the width requirement would affect the ARFF Index of any airport with a Part 139 Certificate, although it is possible that some future aircraft could trigger the ICAO or NFPA width standard. Appendix B contains the list of aircraft and their respective lengths and widths that were used to make this determination.

Numbers of Vehicles

Section 139.317 addresses, among other things, the number of vehicles required by each airport index/category. FAA allows some flexibility in the number of vehicles for Index B and C airports as can be seen in Figure 15. While FAA and ICAO call for three vehicles for Index E airports (NFPA/ICAO categories 9 and 10), NFPA's standard is four vehicles. However, the actual number of vehicles is affected by the response time standards, since meeting response times can require more than one ARFF station.

Figure 15: Minimum Number of ARFF Vehicles Required

ICAO/NFPA Airport Category	FAA Airport Index	Vehicles			Example Aircraft
		ICAO	FAA	NFPA	
4	A	1	1	1	DHC-8-100
5	A	1	1	2	ATR-72
6	B	2	1 – 2	2	B-737-300; Emb-145
7	C	2	2 – 3	3	B-757
8	D	3	3	3	A300; B-767-300
9	E	3	3	4	B-747-200; A340-400
10	E	3		4	AN-225; A380

Quantity of Agent

ICAO first considered standards for the quantity of fire extinguishing agent in 1972. The standards include the concept of theoretical critical area (TCA) and practical critical area (PCA). (These are the physical areas in which firefighting is expected to take place.) The PCA is two-thirds the size of the TCA. A discussion of the TCA and the PCA as well as the mathematical formulas for the TCA and the PCA can be found in NFPA 403, Annex B. The FAA Advisory Circular 150/5210-6D, Aircraft Fire and Rescue Facilities and Extinguishing Agents, also discusses the concepts of control time and extinguishment time. The amounts of extinguishing agents to control and to extinguish a fire are determined separately. The quantities are named and defined as follows.

Quantity Q1—The quantity required to obtain a one-minute control time in the PCA. The formula for the water required for control (Q1) in the PCA can be found in NFPA 403, Annex B.

Quantity Q2—The quantity required for continued control of the fire after the first minute or for complete extinguishment of the fire or both. The amount of water required for Q2 cannot be calculated exactly, as it depends on a number of variables, consisting of the following:

1) Aircraft Size – Aircraft size reflects the potential level of risk. This risk factor is a composite of the occupant load, the potential internal fire load, flammable liquid fuel capacity and fuselage length and width. Careful consideration of all these factors allows the identification of a meaningful operational objective, that is, the area to be rendered fire free (controlled or extinguished).

2) Relative Effectiveness of Agent Selected – This is accounted for by the specific application rate identified for the common generic foam concentrate types.

3) Time Required to Achieve PCA Fire Control – Information from reliable large-scale fire tests, empirical data from a wide variety of sources, and field experience worldwide indicates that one-minute is both a reasonable and a necessary operational objective.

4) Time Required to Maintain the Controlled Area Fire-Free or to Extinguish the Fire – An operational objective that provides a safety factor for the initial fire attack on the PCA while waiting for the arrival of backup support or to complete extinguishment of remaining fires outside the PCA.

Quantity Q3— The quantity of water required for fire-fighting operations in the aircraft interior has recently been established as an ARFF measure. This quantity of water, called Q3, is based on the need for hand lines to be used for interior fire fighting. The actual amount of water comprising Q3 is found in Table B.5.3 of NFPA 403 for the various NFPA categories. The amount ranges from 600 gallons for Category 4 to 5,000 gallons for Category 10, and was adopted by NFPA but was not by the FAA or ICAO.

Figure 16 shows the amount of water required by the FAA, ICAO and NFPA for airport index/category. It is the total amount of water required (or the sum of Q1, Q2 and Q3) to properly mix with the foam concentrate carried on the trucks.

Figure 16: Agent/Quantity Comparison

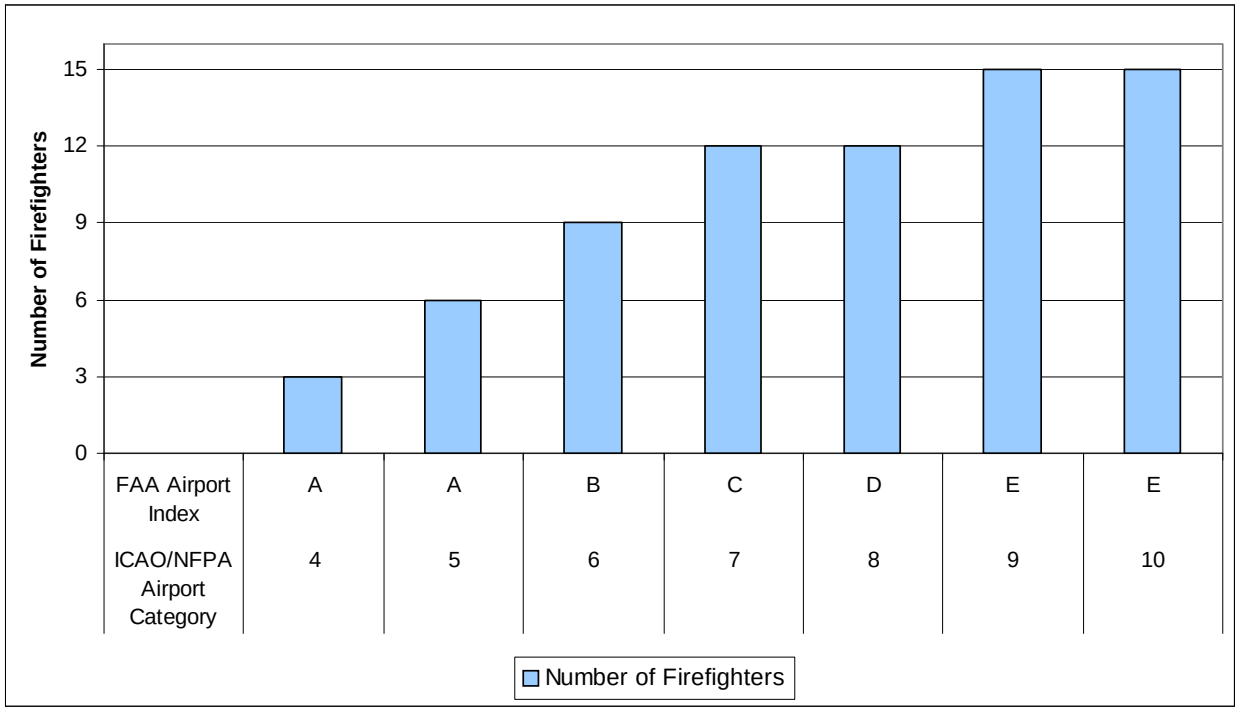
ICAO/NFPA Airport Category	FAA Airport Index	Water (U.S. Gallons)			Example Aircraft
		ICAO	FAA	NFPA	
4	A	634	100	1,340	DHC-8-100
5	A	1,427	100	2,760	ATR-72
6	B	2,087	1,500	3,740	B737-300; Emb-145
7	C	3,197	3,000	4,880	B757
8	D	4,808	4,000	7,780	A300; B767-300
9	E	6,419	6,000	9,570	B747-200; A340-400
10	E	8,533	6,000	14,260	AN-225; A380

Note: NFPA includes a quantity of water for Q1, Q2 and Q3, while FAA and ICAO include only Q1 and Q2.

Staffing

Figure 17 shows staffing requirements in terms of numbers of required firefighters. Neither Part 139 nor ICAO Annex 14 requires specific staffing levels needed for ARFF duties. Part 139 requires a number of trained personnel that will ensure an effective operation. Annex 14 recommends that sufficient trained personnel be available for ARFF operations. The number of vehicles specified under Part 139 and Annex 14 will have some bearing on staffing. Both documents do require that firefighters be properly trained to perform their duties. On the other hand, in NFPA 403, Chapter 8 does specify a minimum staffing level.

Figure 17: NFPA 403 Minimum Required Staffing per Shift



Note: FAA and ICAO do not have an explicit minimum staffing requirement.

Under Part 139, ARFF personnel must be available for ARFF duties 15 minutes before a landing or a takeoff and 15 minutes after the takeoff or landing. This requirement is found in paragraph 139.319 (a) where it specifies that the airport must provide this protection during air carrier operations at the airport. The term "air carrier operations" is defined in Section 139.5, Definitions, as the takeoff or landing of an air carrier aircraft and includes the period of time from 15 minutes before until 15 minutes after the takeoff or landing.

While ICAO Annex 14 makes no mention of the 15-minute before or after time frame, NFPA 403, paragraph 8.1.2, states, "During flight operations and 15 minutes prior and 15 minutes following, a sufficient number of trained personnel shall be readily available to staff the rescue and fire-fighting vehicles and to perform fire-fighting and rescue operations."

None of the documents prohibit ARFF personnel from performing other duties on an airport, provided they are available within the set guidelines to perform the duties of aircraft firefighting and rescue. How these personnel are used is left to the airport operator's personnel policies. In some cases, the personnel are firefighters that have collateral duties; in other cases, they are workers that have a collateral duty as a firefighter.

Response Time

All three organizations require the aircraft rescue and firefighter vehicles to demonstrate that they can respond to a certain point on the airfield within a given period of time. While the point differs among the three organizations, both ICAO (Annex 14, paragraph 9.2.21) and NFPA 403 (paragraph 9.1.3) specify that the response is under optimum conditions of visibility and surface conditions, while FAA Part 139 does not use similar language. However, FAA Order 5280.5C (that provides guidance to the FAA airport certification inspectors) states that the times in the regulation are based on direct routes, dry pavements, and good weather. The response time requirements directly affect the numbers and locations of fire stations; and, as such, these affect both the staffing and vehicles required to provide ARFF services. Figure 18 summarizes the FAA, ICAO and NFPA response time requirements.

Figure 18: Comparison of Response Time Standards

Standard	Demonstrated Response Time in Good Weather and Surface Conditions
FAA	First Vehicle: 3 minutes to mid-point of farthest runway Other Vehicles: 4 minutes
ICAO	First Vehicle: 3 minutes to any point on runway Recommendations: ✈ 2 minutes to any point on runway ✈ Other vehicles 1 minute later
NFPA	First Vehicle: 2 minutes to any point on runway, 2.5 minutes to anywhere in rapid response area (RRA) and 3 minutes in aircraft movement area beyond runway or RRA

FAA Requirements – Paragraph 139.319(h) (2) (i) states: "…Within 3 minutes from the time of the alarm, at least one required aircraft rescue and firefighting vehicle shall reach the midpoint of the farthest runway serving air carrier aircraft from its assigned post or reach any other specified point of comparable distance on the movement area that is available to air carriers, and begin application of extinguishing agent." It goes on to state: "Within 4 minutes from the time of alarm, all other required vehicles shall reach the point specified in paragraph (h) (2) (i) of this section from their assigned posts and begin application of an extinguishing agent."

ICAO Requirements – As contained in Annex 14, 9.2.21, the ICAO standard is as follows: "The operational objective of the rescue and fire fighting service shall be to achieve a response time not exceeding three minutes to any point on each operational runway in optimum visibility and surface conditions." Further Annex 14 contain several recommendations, including Paragraph 9.2.22 that states: "Recommendation - *The operational objective of the rescue and fire fighting service should be to achieve a response time not exceeding two minutes to any point on each operational runway in optimum visibility and surface conditions."*

ICAO Annex 14, Paragraph 9.2.24 recommends: "*Any other vehicles required to deliver the amounts of the extinguishing agents specified in Table 9-2 should arrive no more than one minute after the first responding vehicle(s) so as to provide continuous agent application.*"

NFPA Requirements – As contained in NFPA 403, Paragraph 9.1.3, the standard is: "The demonstrated response time of the first responding vehicle to reach any point on the operational runway shall be 2 minutes or less, and to any point remaining within the on-airport portion of the rapid response area shall be no more than 2½ minutes, in both optimum conditions of visibility and surface conditions. Other ARFF vehicles necessary to achieve the agent discharge rate listed in Table 5.3.1(a) or Table 5.3.1(b) shall arrive at intervals not exceeding 30 seconds."

NFPA further states in Paragraph 9.1.4: "The demonstrated response time to reach an incident/accident involving any aircraft with passengers in the aircraft movement area beyond or outside the runway and rapid response area shall be 3 minutes or less, both in optimum conditions of visibility and surface conditions to meet the requirements in Table 5.3.1(a) or Table 5.3.1(b).

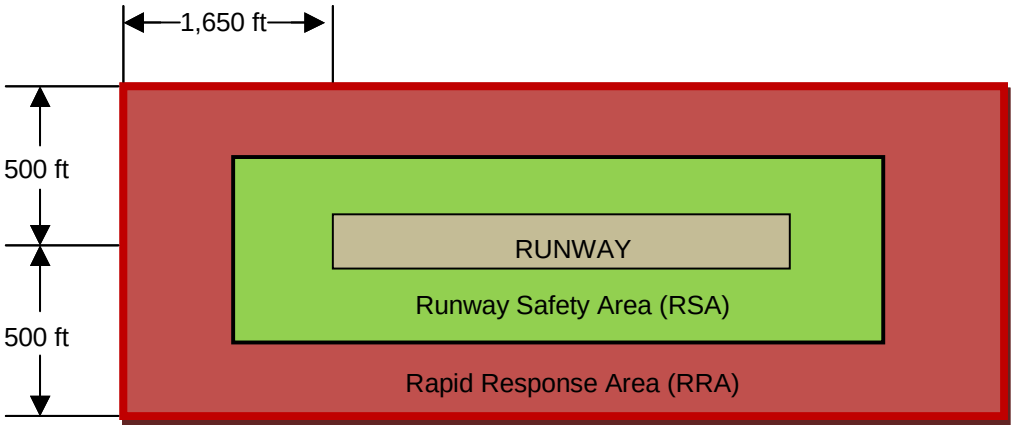
Additionally, in 3.3.11.2, NFPA defines movement area as that part of an airport to be used for the take-off, landing and taxiing of aircraft, and includes the apron(s). This definition basically is the same definition as used by ICAO. It differs from the FAA definition of movement area found in Section 139.5, Definitions. Movement area, in Section 139.5, means the runways, taxiways, and other areas of an airport that are used for taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and aircraft parking areas.

Rapid Response Area

NFPA defines Rapid Response Area (RRA) in NFPA 403, 3.3.11.3 (2009) as: A rectangle that includes the runway and the surrounding area extending to a width of 500 ft (150 m) outward from each side of the runway centerline and to a length of 1,650 ft (500 m) beyond each runway end but not beyond the airport property line. Neither FAA nor ICAO has a similar provision in their standards.

Figure 19 shows the maximum area of the RRA as specified in the NFPA standards. This area would have a width of 1,000 feet (500 feet each side of the runway centerline) and extend 1,650 feet beyond each runway end. The actual RRA for a runway is limited to the area within Figure 34 that is located on airport property. NFPA standards state that any point in a runway's RRA must be accessible to ARFF vehicles. The first responding vehicle must be able to reach any point in the on-airport RRA within 2 ½ minutes during conditions of optimum visibility and surface conditions, with other required ARFF vehicles arriving in 30 second intervals.

Figure 19: Illustration of Rapid Response Area



Remission Provision

The provisions of Part 139.315 (c) and Annex 14, Paragraph 9.2.3 allow an airport operator to maintain the next lower Index if there are limited operations by the largest aircraft. Under Part 139 the airport operator is allowed to provide the next lowest Index when there are less than 5 average daily departures by the longest aircraft. Under Annex 14 the airport operator is allowed to provide the next lowest Index when there are less than 700 aircraft movements in the busiest three consecutive months. ICAO uses the term movement to mean takeoff or landing—this translates into an approximate average of 4 departures per day during the three consecutive busy months. Despite these minor differences, the Part 139 and ICAO provisions are considered to be the same for purposes of this analysis. The ability of an airport to operate at a lower ARFF level when there are limited operations by the largest aircraft is referred to as the remission provision. NFPA 403 does not have a similar provision affording this flexibility.

Reduction of Fire Fighting Capability

During periods of reduced activity the provisions of Part 139.319 (c) and ICAO Annex 14, Paragraph 9.2.7 allow the airport operator to reduce its ARFF coverage to that required by the aircraft using the airport during the reduced activity periods. For example, an airport has five departures by aircraft requiring Index C coverage between 7 AM and 9 AM and another five departures by aircraft requiring Index C coverage between 5 PM and 7 PM. During the remainder of the day, all its air carrier operations require Index A coverage. The Part 139 and Annex 14 provisions allow the airport operator to reduce its ARFF coverage to Index A from 9 AM to 5 PM. NFPA does not have a similar provision, which implies that an airport would have to have a larger ARFF presence.

Also, under Part 139, the requirement for ARFF services applies only to air carrier passenger operations. Consequently under the provisions of Part 139.319(c), it is permissible to cease ARFF services when there are no air carrier passenger operations. ICAO and NFPA do not limit ARFF services to just air carrier operations. Under the provisions of Annex 14 and NFPA 403, ARFF services would also apply to general aviation operations. Consequently, under those standards, ARFF services would always be provided when the airport is open, which could have a large impact on airports with limited passenger air carrier operations.

Firefighter Training Requirements

Part 139.319(i)(2) requires firefighters be trained to perform their duties and lists eleven specific areas firefighter training must address. FAA requires firefighters to have a live-fire drill once every 12 months, and to have recurrent training. The eleven areas are:

1. Airport familiarization
2. Aircraft familiarization
3. Rescue and firefighting personnel safety
4. Emergency communications systems on the airport
5. Use of fire equipment
6. Application of extinguishing agents
7. Emergency aircraft evacuation assistance
8. Fire fighting operations
9. Adapting structural fire and rescue equipment for airport use
10. Air cargo hazards including hazardous materials
11. Familiarization of firefighters duties under the airport emergency plan

ICAO Annex 14 requires all firefighters to be trained to perform their duties in an efficient manner. Guidance on the training is provided in (a) Annex 14 Attachment A, Section 17, (b) Airport Services Manual and (c) Training Manual, Part E-2. The guidance in Attachment A, Section 17 addresses subject areas similar to those contained in Part 139. Another ICAO document, Part E-2, Aerodrome Fire Services Personnel Training Manual, contains a list of training parallels very close the list in Attachment A of Annex 14. This document is dated 1976 and has not been updated since.

Paragraph 8.1.4 of NFPA 403 requires all firefighters to meet the requirements of NFPA 1003, Standard for Airport Fire Fighter Professional Qualifications. This latter document requires that for a person to be certified as an airport firefighter, he/she must meet the requirements for Fire Fighter II that are defined in NFPA 1001, Standard for Fire Fighter Professional Qualifications. Among other things, this requires a person to qualify as a structural firefighter before becoming an airport firefighter.

Emergency Plans and Drills

The FAA, ICAO, and NFPA have requirements in their respective standards that an emergency plan be developed for the airport--FAA's requirements are contained in Part 139.325, ICAO's are in Annex 14, 9.1 and NFPA's are in NFPA 403, paragraph 4.2. The intent of all three standards is essentially the same—airport operators need to work with local political jurisdictions to develop coordinated responses to natural, (e.g., hurricanes) or manmade emergencies (e.g., aircraft accidents) that may occur on or in the vicinity of the airport.

All three bodies require that a full-scale exercise be conducted periodically to test the emergency plan. FAA standards include a requirement for this full-scale exercise to be conducted every three years, with a tabletop exercise being held in years when a full-scale exercise is not conducted. ICAO and NFPA standards call for the full-scale exercise to be conducted every two years with the tabletop exercise being held in the year when a full-scale exercise is not conducted.

SUMMARY

The major differences between the current Part 139 and ICAO/NFPA standards are in the demonstrated response drills, i.e., the time allowed for the response and the location that must be reached in that time, minimum staffing and equipment levels, and training. In addition, the response time requirement directly affects that number and location of needed fire stations and therefore required staffing and ARFF vehicles. Any actual differences in future ARFF standards would depend on how ICAO and NFPA standards entered into changes to Part 139. Under existing procedures FAA would have to justify such changes and conduct a regulatory evaluation. In addition, the proposed legislation would require that FAA justify cases where it did not adopt voluntary consensus standards (it is general government practice to base regulations on common standards).

Section 4 of the report reviews the current level of ARFF services at airports certified under Part 139. Section 5 examines the incremental impact and costs of adopting ICAO and/or NFPA standards.

SECTION 3
ARFF-RELATED ACCIDENT HISTORIES IN THE UNITED STATES

INTRODUCTION

Air carrier accidents over an eleven-year period (January 1, 1997 to December 31, 2007) were reviewed to determine if revised ARFF standards would have made a difference in the number of fatalities. The review included all fatal accidents in the United States for Part 121 scheduled or non-scheduled operations and Part 135 scheduled air taxi or commuter operations. There were 23 Part 121 accidents and 13 scheduled Part 135 accidents that occurred during the review period. The most recent reviewed accident occurred on July 10, 2007.

PART 121 ACCIDENTS

Eleven Part 121 aircraft accidents occurred far from airport property, according to the NTSB reports. As such, these accidents were not considered to be relevant to an ARFF response because they did not occur on or in proximity to an airport. These accidents include four aircraft from the 9/11 terrorist attacks, an American Airlines Airbus-300 that crashed in Belle Harbor, NY in November, 2001 and an Alaska Airlines MD-83 that crashed in the Pacific Ocean in January 2001.

Of the remaining 12 Part 121 aircraft accidents, nine were not considered to be of interest from the ARFF perspective even though they occurred on airport property. These accidents include seven accidents involving fatalities to ground personnel, such as someone walking into a propeller, someone getting sucked into a jet engine or a collision between ground equipment and parked aircraft. Another fatality involved the death of a flight attendant who opened a door of a pressurized aircraft. These accidents also included a boy who was killed while he was riding in his family car on a city street when a Southwest Airlines aircraft overran the runway at Chicago Midway Airport.

The three Part 121 accidents of interest required reviewing the pertinent sections of the full NTSB report to determine if different ARFF standards might have had any impact on the outcome in terms of reducing the severity of injuries or in preventing deaths. A brief summary based upon the NTSB accident report is provided for each one of these accidents.

Little Rock, Arkansas, June 1, 1999—An American Airlines MD-82 carrying 139 passengers and a crew of six overran Runway 4R while landing during a rainstorm. After departing the runway, the aircraft struck the localizer, ran through a chain link security fence and struck support structures for the Runway 22L approach light system before coming to rest on airport property on a flood plain that was located several feet

below the runway elevation and approximately 800 feet from the departure end of the runway. According to the NTSB, the ARFF response (three trucks with four fire-fighters each) was affected by communication as to the aircraft location, limited visibility due to the rainstorm and circuitous route that needed to be taken to the accident site. It was estimated that they were able to extinguish the fire within 60 seconds of reaching the accident site. The coroner determined that the captain and five of the passengers died from traumatic injuries and five other passengers died from smoke and soot inhalation and/or thermal injuries. In its analysis, the NTSB determined that the accident was potentially survivable for two of the passengers that died. The NTSB determined that even with a shorter ARFF response time, the lives of these two passengers would not have been saved if emergency responders had arrived on the scene earlier. In one case, the passenger would have had to evacuate the aircraft immediately, and in the second case the ARFF response team would have had to enter the aircraft instead of first suppressing the fire.

Charlotte, North Carolina, January 8, 2003—A US Airways Express Beech 1900 crashed into a maintenance hangar shortly after takeoff from Runway 18R at Charlotte-Douglas International Airport. The aircraft was destroyed by impact and post crash fire. It was determined that all 21 people on board the aircraft died from "multiple blunt injuries due to an airplane crash."

Lexington, Kentucky, August 27, 2006—A Comair CRJ-100 took off on the wrong runway at Blue Grass Airport, ran off the end of the runway and impacted the perimeter fence, trees and terrain. The accident site was located off airport property approximately 1,800 feet from the departure end of the runway. The accident site was not directly accessible to ARFF vehicles from the runway end. It took the ARFF vehicles approximately 11 minutes to travel about 2 ½ miles by public roads, a dirt road with a significant incline and off-road terrain to reach the site The fire was controlled by the ARFF response in about three minutes. Of the 50 people on board only the first officer survived. There were several passengers who survived the crash but died due to smoke inhalation or thermal injuries. The NTSB found it was not possible to determine how long these passengers survived but noted that all of the passengers were found close to their seats. The Safety Board noted that the emergency response for this accident was timely and well coordinated under the circumstances.

SCHEDULED PART 135 ACCIDENTS

In 2004, Part 139 was amended to require airports receiving scheduled Part 135 operations with aircraft having more than nine passenger seats to be certificated. This change did not apply to airports located in the state of Alaska. Of the 13 accidents involving scheduled Part 135 operations, 10 occurred in Alaska. The site of these accidents varied from 300 yards from the airport to 49 miles from the airport.

Of the three accidents that occurred in the "lower 48" only two occurred on the airport and neither one of these airports was required to be certificated under Part 139. The autopsies from one of these two accidents (which occurred in 2000) revealed that four of the fatalities resulted from asphyxia from smoke inhalation and/or thermal injuries. However, even with the change in 2004 to Part 139, this Part 135 operation would not have been affected since the aircraft had only nine passenger seats and, therefore, the aircraft was not required to operate only at certificated airports.

ANALYSIS

NTSB indicates that some people on board the aircraft at Lexington and Little Rock survived the initial crash, i.e., they did not experience any life-threatening traumatic injuries from the crash, but they subsequently died from thermal injuries and/or smoke inhalation. However, it is not clear that the adoption of NFPA 403 standards or ICAO Annex 14 standards would have resulted in their survival. The accident site at Lexington was located off airport property and outside NFPA's prescribed Rapid Response Area. Even if the NFPA standards were in effect, the survivability of this accident would not have changed because there still would have been a substantial period of time before ARFF could have reached the aircraft. In its analysis of the Little Rock accident, the NTSB found that the accident was survivable for two of the passengers. However, the NTSB also determined that an improved ARFF response time to this accident would not have resulted in any additional lives being saved.

It is difficult to suggest what might happen in terms of future accidents. With the very small number of accidents in passenger air carrier operations and the multiplicity of causes and outcomes, it is not possible to reach a conclusion about future mortality from past accidents. This type of problem may be addressed through a modeling and simulation-based analysis, but this was beyond the scope of the current project. However, the review of accidents described above suggests that enhanced ARFF standards may have made a difference in the outcome for at most one individual.

SECTION 4
DATA COLLECTION AND ANALYSIS

INTRODUCTION

There are 476 Part 139 Class I, Class II and Class III airports. Given the available resources and level of detailed information required, the study used a representative sample to survey airports of different sizes and from different parts of the Continental U.S. Figure 20 shows the distribution of airports by group, and the number and percentage of interviews completed for each (Class II and II airports are reported as one group). Interviews were completed with 53 airports (11.1 percent of the 476 airports).

Figure 20: Airport Population and Interviews Completed

Number and Percentage of Part 139 Certificate Holding Airports							
	Airport ARFF Classification						
	IIIA/IIA	IA	IB	IC	ID	IE	Total
Interview Response	8	11	13	12	5	4	53
Total Certified	99	131	111	78	33	24	476
Percentage	8.1%	8.4%	11.7%	15.4%	15.2%	16.7%	11.1%

Note: Four of the 476 airports have inactive certificates (see Appendix A). There are 86 additional Class IV airports, of which 16 have inactive certificates.

The research assembled detailed information from airport operators on the scope and costs of their current ARFF operations in order to analyze the impacts of changing the ARFF requirements (the Interview Guide used with the airports is contained in Appendix C). These included estimates of the operating and infrastructure cost changes associated with adoption of regulations that reflect the ICAO and/or NFPA standards. Figure 21 provides a listing of the individual airports that were interviewed, along with the number of runaways at each airport.

Figure 21: List of Airport Interviews

Class	Index	LOC ID	City	State	Runways
I	E	ATL	Atlanta	GA	5
I	E	DEN	Denver	CO	6
I	E	MSP	Minneapolis-St. Paul	MN	4
I	E	DFW	Dallas-Ft Worth	TX	7
I	D	OAK	Oakland	CA	3
I	D	SAN	San Diego	CA	1
I	D	BWI	Baltimore-Washington	MD	4
I	D	PIT	Pittsburgh	PA	4
I	D	TPA	Tampa	FL	3
I	C	HSV	Huntsville	AL	2
I	C	TUS	Tucson	AZ	2
I	C	DCA	Washington National	DC	3

Class	Index	LOC ID	City	State	Runways
I	C	SRQ	Sarasota-Bradenton	FL	2
I	C	SDF	Louisville	KY	3
I	C	MCI	Kansas City	MO	3
I	C	JAN	Jackson	MS	2
I	C	MHT	Manchester	NH	2
I	C	RNO	Reno	NV	3
I	C	CMH	Port Columbus	OH	2
I	C	OKC	Oklahoma City	OK	3
I	C	MSN	Madison	WI	3
I	B	XNA*	Fayetteville	AR	1
I	B	CID	Cedar Rapids	IA	2
I	B	FWA	Fort Wayne	IN	3
I	B	MSO	Missoula	MT	1
I	B	LNK	Lincoln	NB	3
I	B	BIS	Bismarck	ND	2
I	B	BGM	Binghamton	NY	2
I	B	AVP	Wilkes Barre-Scranton	PA	1
I	B	CHA	Chattanooga	TN	2
I	B	ROA	Roanoke	VA	2
I	B	PSC	Pasco	WA	2
I	B	ATW	Appleton	WI	2
I	B	CRW	Charleston	WV	2
I	A	FLG	Flagstaff	AZ	1
I	A	GNV	Gainesville	FL	2
I	A	ALO	Waterloo	IA	3
I	A	HYA	Hyannis	MA	2
I	A	SBY	Salisbury	MD	2
I	A	BHB	Bar Harbor	ME	1
I	A	BRD	Brainerd	MN	3
I	A	HKY	Hickory	NC	2
I	A	TTN	Trenton	NJ	2
I	A	LCK*	Columbus-Rickenbacker	OH	2
I	A	CPR	Casper	WY	2
II	A	DEC	Decatur	IL	3
II	A	HYS	Hays	KS	2
II	A	MHK	Manhattan	KS	2
II	A	ART	Watertown	NY	2
II	A	LNS	Lancaster	PA	2
III	A	CIC	Chico	CA	1
III	A	FMN	Farmington	NM	2
III	A	SGU	St. George	UT	1

*During the interview program LCK indicated that it has become an Index B airport and XNA reported that it is now an Index C airport.

STUDY AIRPORT ATTRIBUTES

Figure 22 shows the number of firefighters at the airports interviewed. As can be seen, nearly all the firefighters are full-time employees. (A full-time employee may not spend all their work time as a firefighter. Some airports have firefighters perform other

duties.) This figure also shows the average number of firefighters in each airport group (by class and index).

Figure 22: Firefighters

Firefighters								
Firefighters	Airport ARFF Classification							Percentage
	IIIA/IIA	IA	IB	IC	ID	IE	Total	
Full-time	55	97	149	230	215	460	1,206	93.7%
Part-Time	5	6	44	26	-	-	81	6.3%
Total	**60**	**103**	**193**	**256**	**215**	**460**	**1,287**	**100.0%**
Airports Responding	8	10	13	9	5	4	49	
Average Total Firefighters	**8**	**10**	**15**	**28**	**43**	**115**	**26**	

Because some firefighters work part time, Figure 23 shows the distribution of full-time equivalent employees (FTEs) for the airports. It is useful to track FTEs because there are full-time employees who only perform firefighting duties part time. As can be seen, about 23 percent of the airports have three or fewer full-time equivalent firefighters. Almost 60 percent of the airports have fewer than 15 full-time equivalent firefighters.

Figure 23: Number of ARFF Full-Time Equivalent Employees

Number of ARFF Full Time Equivalent Employees at Responding Airports								
Number of FTEs	Airport ARFF Classification							Percentage
	IIIA/IIA	IA	IB	IC	ID	IE	Total	
3 or fewer	5	5	2	0	0	0	12	22.6%
3.1 to 6	0	4	5	0	0	0	9	17.0%
7 to 15	3	1	4	2	0	0	10	18.9%
16 to 30	0	0	1	6	2	0	9	17.0%
30 to 50	0	1	1	4	2	1	9	17.0%
50 to 200	0	0	0	0	1	3	4	7.5%
Total Airports	**8**	**11**	**13**	**12**	**5**	**4**	**53**	**100.0%**

Figure 24 shows that, at about half of the airports studied, firefighters are employees of the airport. It is also common for them to be members of a municipal (city or county) fire department. In some cases firefighters are employees of a contractor hired to provide ARFF services or members of a military unit stationed at the airport.

Figure 24: Employer of Firefighters

Employer of Firefighters								
Employer	Airport ARFF Classification							Percentage
	IIIA/IIA	IA	IB	IC	ID	IE	Total	
Airport	4	6	7	5	2	2	26	49.1%
Municipality	4	2	2	1	3	2	14	26.4%
Military	-	1	1	2	-	-	4	7.5%
Contractor	-	1	2	4	-	-	7	13.2%
Other	-	1*	1**	-	-	-	2	3.8%
Total	**8**	**11**	**13**	**12**	**5**	**4**	**53**	**100.0%**

*Airline; and **State

Figure 25 shows the ARFF hours of operation at the airports interviewed. As can be seen, over 80 percent of the airports provide ARFF services 24 hours per day. A small number of the airports interviewed provided services only when commercial aircraft were operating.

Figure 25: Hours of ARFF Operation

Hours of ARFF Operation at Responding Airports							
Hours of ARFF Operation per Day	IIIA/IIA	IA	IB	IC	ID	IE	Total
0 - 16 hours	1						1
17 - 23 hours	1	4	1	0	0	0	6
24 hours	4	6	12	12	5	4	43
15/30 minutes before and after each flight*	2						2
30 min before first flight of day and 30 minutes after last**		1					1
Total	**8**	**11**	**13**	**12**	**5**	**4**	**53**

*ARFF is available 15 or 30 minutes before each commercial flight until 15 minutes after each flight during the day.
**ARFF is available from 30 minutes before the first commercial flight of the day until 30 minutes after the last commercial flight of the day.

Figure 26 shows the number of primary firefighting vehicles at the airports interviewed. About 40 percent of the airports have only one vehicle. Eighty percent of the airports have three or fewer vehicles.

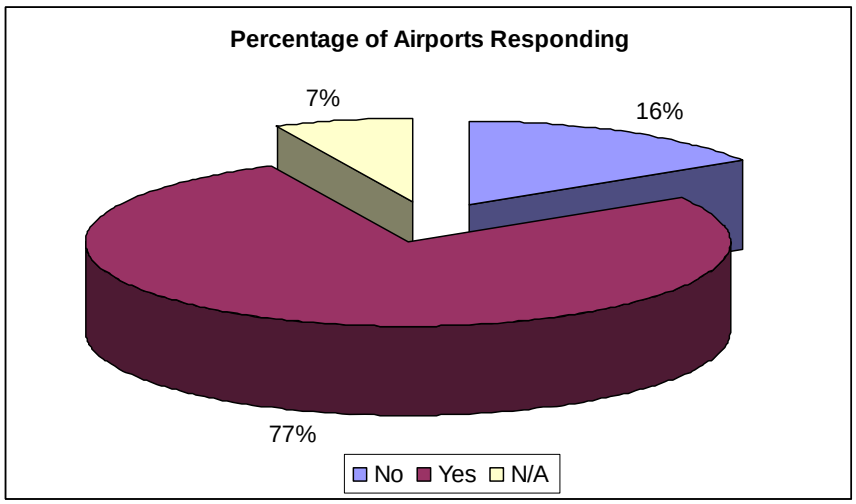
Figure 26: Number of Firefighting Vehicles (Reserve Units Excluded)

Number of Firefighting Vehicles (Reserve Units Excluded)								
Primary Vehicles	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Airports**	**Vehicle Count**
One	6	6	6				18	**18**
Two	2	4	5	2			13	**26**
Three		1	2	7	1		11	**33**
Four				2	2	1	5	**20**
Five				1	1		2	**10**
Six					1		1	**6**
Seven						1	1	**7**
Eight						1	1	**8**
Ten						1	1	**10**
Total	**8**	**11**	**13**	**12**	**5**	**4**	**53**	**138**

Airports supplement their own on-site firefighting by using surrounding fire departments that provide mutual aid. These are firefighting units located off the airport, which have an agreement to assist the airport as needed.

NFPA and/or ICAO have standards related to structural firefighting, and responding to hazardous material and other incidents. Figure 27 shows that at over 75 percent of the airports, ARFF also responds to structural fires. At many of the airports interviewed, the ARFF units at airport react to structural fires in the role of first responder, i.e., they cede the responsibility for the fighting the fire to the municipal fire department when it arrives on the scene.

Figure 27: Requirement for ARFF Response to Structural Fires



The research investigated whether ARFF crews also had structural fire training. As shown in Figure 28, 80 percent of ARFF firefighters are also trained as structural firefighters. It is a state-mandated requirement at 34 percent of the airports.

Figure 28: ARFF Crews Having Structural Fire Training at Responding Airports

ARFF Crews Having Structural Fire Training at Responding Airports								
Response to Question 1	**Response to Question 2**	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
No	N/A	3	4	3				10
Yes	No	3	4	5	6	2	1	21
Yes	Yes	1	2	3	6	3	3	18
Yes	Not Sure	1	1	2				4
Total		**8**	**11**	**13**	**12**	**5**	**4**	**53**

Question 1: Are your firefighters trained as structural firefighters, as well as aircraft firefighters?
Question 2: If so, is this a state requirement?

The study also asked whether firefighters were trained to handle hazardous material (HAZMAT) incidents. By and large, most of the firefighters had some form of HAZMAT training under NFPA 472, as shown in Figure 29. There are multiple types of training and the numbers of airports that have staff trained to various levels are indicated. In general, most of the crews have HAZMAT training at the operations and/or technician level.

Figure 29: ARFF Crew HAZMAT Training

ARFF Crew HAZMAT Training							
HAZMAT	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 472 Awareness	1	1	1	1			4
NFPA 472 Awareness and Operations		1	1	1			3
NFPA 472 Operations	2	3	3	6	1		15
NFPA 472 Operations and Technician	1		3	1	3	1	9
NFPA 472 Technician		1	2	3		3	9
NFPA 472 Specialist		1					1
NFPA 472 Other*	1	3	1		1		6
NFPA 472 Unknown	1						1
NFPA 472 Outside**	2	1	2				5
Total	**8**	**11**	**13**	**12**	**5**	**4**	**53**

*State, university or FAA guidelines
**HAZMAT team is provided by an off-airport organization (e.g. city fire department)

Figure 30 shows the number of airports that have training to recognize and respond to incidents involving weapons of mass destruction (WMD). About 40 percent of airport firefighters do not have WMD training, and 20 percent only have WMD awareness training. NFPA WMD training is most prevalent at the largest Class I airports (Index D and E).

Figure 30: WMD Standard for Training of ARFF Crewmembers

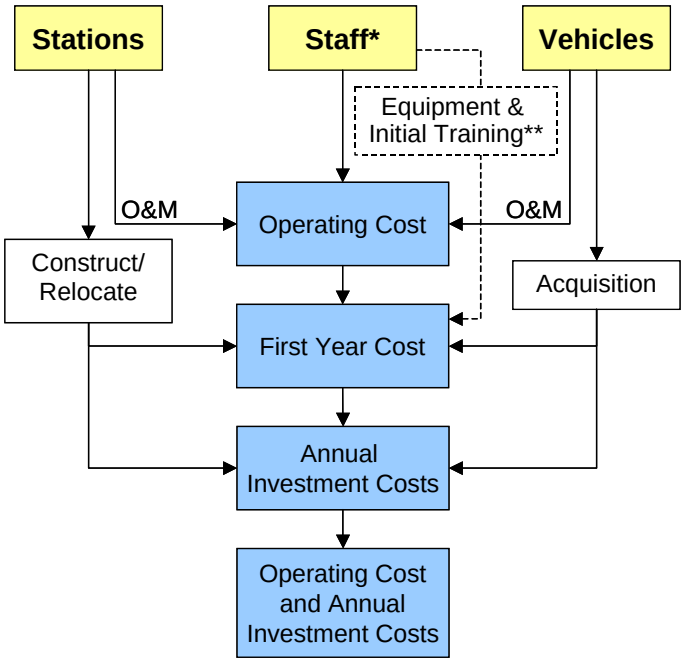
WMD Standard for Training of ARFF Crewmembers							
WMD Standard	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
No WMD training	4	7	4	5		1	21
Military WMD training			2	2			4
NFPA	1	1		2	2	3	9
ODP Awareness*	2	2	2	3	2		11
Part 139			1				1
State			1				1
First Responder**			2				2
Unknown	1	1			1		3
No response			1				1
Total	**8**	**11**	**13**	**12**	**5**	**4**	**53**

*Office for Domestic Preparedness
**State-mandated training for law enforcement and emergency medical personnel

COST ANALYSIS

There are a number of costs that will determine the impact of adopting NFPA or ICAO ARFF standards at existing Part 139 airports. These include the additional ARFF vehicles, firefighters and fire stations required to meet these standards. These costs were developed from interviews with airport managers as well as secondary source data. These are reported as annual operating costs and investment costs. Figure 31 shows a schematic of how costs are built up.

Figure 31: Cost Build Up Schematic



*Staff costs include salary, benefits and other recurring expenses
**Uses five-year average staff turnover

Operating costs consist of salaries, benefits and related costs for firefighters, and operating and maintenance costs for buildings and equipment. Investment costs consist of construction costs for fire stations and acquisition costs for vehicles. Annual investment costs are developed using a 30-year life for buildings and a 15-year life for vehicles (with a ten percent residual value) and represent an amortization of the construction or purchase costs over the investment's useful life. Investment costs are shown in two ways:

1. First year cost sums the operating and investment costs under the assumption that the airport has to provide this level of resources in order to meet the commitment in expanding fire stations to meet response time requirements.
2. Operating and annual investment costs are shown because this is the amount that would typically flow through an airport's financial statements into its base for rates and charges.

Both numbers are relevant because, in the case of first year costs, this would apply in situations where airports either cannot borrow or do not obtain grant funds for the needed stations and equipment. In situations where funding for these could be obtained through borrowing, then depreciation is a relevant charge. If the investment funds were obtained via grants, then they would not enter the rate base and the operating costs alone would be the relevant measure. The sections below show how station, vehicle and firefighter equipment and training costs are annualized. (Appendix D contains supplementary cost data.)

ARFF Station Costs

Figure 32 shows the estimated cost of building a new ARFF station, should an airport have to add or relocate a fire station under ICAO or NFPA standards. These costs vary based on ARFF index and are driven by the number of vehicles and firefighters that would be housed in the station. The cost information was developed from various sources including airport interviews and the amount of funding provided to airports to build new ARFF stations under previous FAA Airport Improvement Program (AIP) grants. These should be viewed as order of magnitude estimates, which do not reflect construction cost differences due to geography, climate or other factors. The figure also shows the annual investment cost and yearly operating and maintenance (O&M) costs for these stations. A satellite station is one with minimal facilities used to house vehicles and staff, but which is needed to meet response time requirements to some point on the airport.

Figure 32: Estimated ARFF Station Costs

Airport Class	Station Construction or Relocation Cost	Station Annual Investment Cost	Station Annual Utility and Maintenance Cost
Index A	$2,000,000	$66,667	$100,000
Index B	$3,500,000	$116,667	$175,000
Index C	$6,000,000	$200,000	$300,000
Index D	$9,000,000	$300,000	$450,000
Index E	$12,000,000	$400,000	$600,000
Satellite Stations	$3,500,000	$116,667	$175,000

ARFF Vehicles

When additional fire stations are added, there is a requirement to add additional staff and vehicles for each of the stations. These costs were estimated under two scenarios: 1) all stations being full standalone stations, and 2) the situation where Index D and Index E airports are assumed to add smaller satellite stations. Figure 33 shows the ARFF vehicle costs, which are based on airport interviews and information from ARFF vehicle manufacturers. It includes estimates of the annual investment costs to amortize purchase costs and annual fuel and maintenance costs.

Figure 33: ARFF Vehicle Costs

Airport Class	Vehicle Purchase Cost	Vehicle Annual Investment Cost	Vehicle Annual Fuel and Maintenance Cost
Index A	$275,000	$16,500	$13,750
Index B	$675,000	$40,500	$33,750
Index C	$800,000	$48,000	$40,000
Index D	$800,000	$48,000	$40,000
Index E	$800,000	$48,000	$40,000
Satellite Stations	$800,000	$48,000	$40,000

Firefighter and Firefighter-Related Costs

The estimates of costs for additional firefighter costs come from the airport interviews. These were estimated for each airport based on the number of firefighters needed and that airport's cost per firefighter. It was assumed that five firefighters are needed to cover one position on a shift if the station operates 24 hours, seven days a week. If the station operates for more than 16 but less than 24 hours a day, it requires four firefighters to cover one position on a shift. If firefighters are on duty for less than 16 hours per day or are only available when commercial activity takes place, it was assumed that three firefighters are needed to cover one position on a shift. For each new firefighter added, there is an additional cost for firefighter equipment and training.

The initial cost to hire and train a firefighter is estimated at $10,000. A five-year turnover cycle was assumed for firefighters so the annualized equipment and training costs are $2,000 per person.

SUMMARY

The interviews produced information for the airports interviewed in terms of basic attributes such as numbers of runways, ownership, existing staffing, equipment, training and other factors. As noted above, the interviews also provided information on costs for firefighters, vehicles and fire stations, which were supplemented by additional data and converted into annualized costs. These data are used in Section 5 to assess the potential costs of implementing new ARFF provisions based on ICAO Annex 14 and/or NFPA 403 standards.

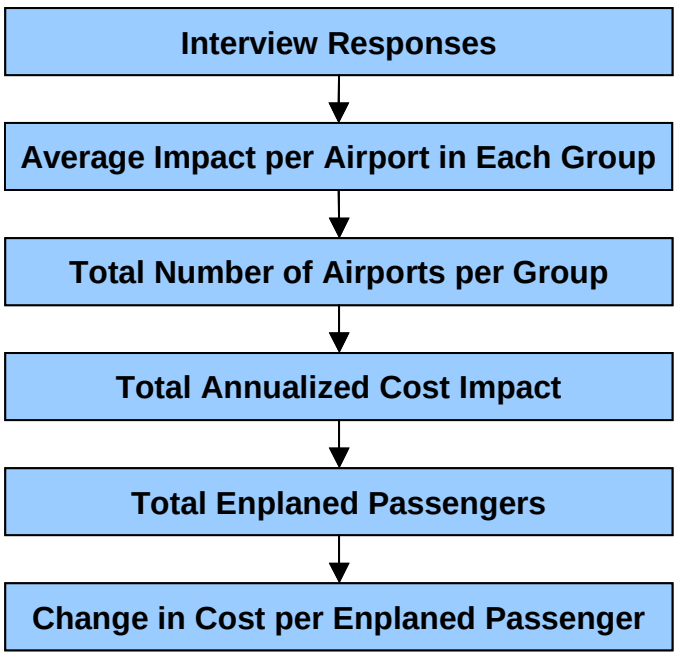
SECTION 5
COST ANALYSIS OF ICAO-NFPA STANDARDS

INTRODUCTION

This section uses data from the airport interviews to assess the potential cost impacts of using ICAO and/or NFPA standards as a basis for ARFF regulations in the U.S. The analysis includes estimates of operating cost impacts, as well as any needed investments that would result from adoption of ICAO or NFPA standards. The incremental impacts are measured over and above the ARFF services provided currently, which may exceed Part 139 requirements. Impacts are reported as total costs and annual average costs per airport, as well as the change in cost per enplaned passenger. The analysis uses estimated costs for the airports that were interviewed to calculate and average cost per airport for each group.

Figure 34 illustrates how the cost estimates for the 476 Class I, II and III Part 139 airports are developed. Costs are based on the interviews with Part 139 airports, and are used to develop an average impact for each airport group. The average costs per airport multiplied by the number of Part 139 airports in each group produces the estimated total costs. The analysis makes no assumptions about the level of FAA or other grant funding to offset the costs of new stations or vehicles. The annual cost is converted into a cost per enplaned passenger to allow readers to assess the potential impact on air service.

Figure 34: Cost Estimation Approach



The numbers and locations of airport fire stations and associated staffing requirements under both NFPA and ICAO are determined by the locations that must be reached, and the time allowed for the ARFF response to those locations, during demonstrated response drills. ICAO response time requirements include meeting the ICAO minimum vehicle requirements, and NFPA response time requirements include meeting the NFPA minimum vehicle and staffing requirements.

Sections 5.2 and 5.3 analyze the cost impacts on airports of ICAO and NFPA standards. After this, Section 5.4 discusses those costs that could not be quantified into dollar cost estimates, including the NFPA rapid response area requirement. Section 5.5 presents estimates the changes in airport costs and the costs per enplaned passenger.

Figure 35 provides baseline data on the numbers of firefighters and vehicles for the 476 Class I, II and III Part 139 airports. The results for Class II and III airports are reported in a single group. These were developed by expanding the average numbers of firefighters and vehicles obtained during the interviews to the total numbers of airports in each group. Overall, there are approximately 10,000 firefighters and over 1,000 ARFF vehicles at Class I, II, and III Part 139 airports.

Figure 35: Estimated Numbers of Firefighters and ARFF Vehicles at 476 Class I, II and III Part 139 Airports

Extrapolation of Reported Firefighters and Trucks to Total Number of Part 139 Airports							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Firefighters From Interviews	60	103	193	256	215	460	1,287
Number Of Airports Responding	8	10	13	9	5	4	49
Average Number of Firefighters	8	10	15	28	43	115	26
Estimated Firefighters for 476 Airports	**743**	**1,349**	**1,648**	**2,219**	**1,419**	**2,760**	**10,137**
Number of ARFF Vehicles From Interviews	10	17	22	38	22	29	138
Number Of Airports Responding	8	11	13	12	5	4	53
Average Number of ARFF Vehicles	1	2	2	3	4	7	3
Estimated ARFF Vehicles for 476 Airports	**124**	**202**	**188**	**247**	**145**	**174**	**1,080**

In the analyses below, the estimated increase in firefighters, vehicles and stations is reported for the sample of airports and is expanded to population of 476 airports. Total costs are estimated for the 476 airports, while the change in cost per enplaned passenger is based on the sample of airports responding to that question.

ICAO ARFF STANDARDS

The adoption of ICAO ARFF standards would have two impacts. The minimum vehicle requirements for airports would require additional ARFF vehicles, as well as the staffing for them; the three-minute demonstrated response time to reach the end of the farthest runway requires additional fire stations, vehicles and firefighters.

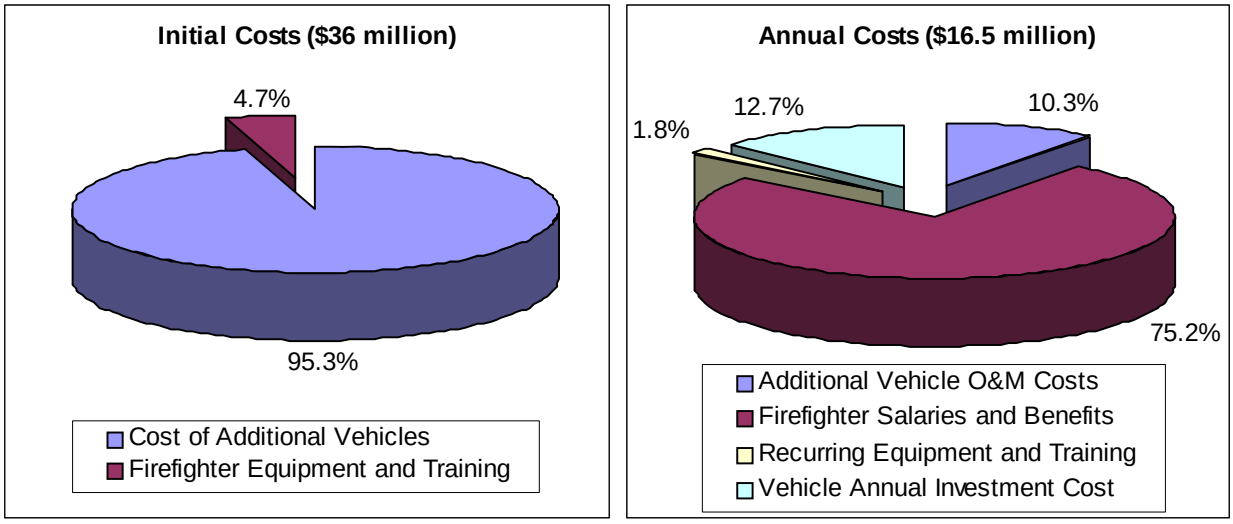
Minimum Vehicle Requirements

The ICAO minimums vehicle requirement only impacts Class IB airports; the 111 airports in this group will require a total of 51 new vehicles and 171 additional staff. The estimated cost impacts of adding these vehicles and the staff needed for them, include:

- Total initial costs for vehicles and firefighter equipment and training are approximately $36 million
- Annual costs (which include annual depreciation) are about $16.5 million, or about $150,000 per Class IB airport.

Figure 36 shows the distribution of these costs; the largest impacts are the cost of new vehicles and the additional firefighters. The impact of the ICAO minimum vehicle standard on the cost per enplaned passenger at Class IB airports is $0.52 per enplanement, or about a 1.5 percent increase.

Figure 36: Impact of ICAO Minimum ARFF Vehicle Requirements ($ millions)



Three-Minute Response Time

Figure 37 shows the number of airports interviewed that meet the ICAO standard three-minute response time demonstration requirements to the farthest runway end. As can be seen, 33 of the airports can meet this standard, while 20 do not. Six of these 20 airports do not meet this standard, but it would possible to relocate an existing fire station to meet this standard (i.e., close an existing station and build a new one to replace it). At 14 airports, the airport would need to add additional fire stations to meet this requirement. Eighteen airports would need to add/relocate one station, one airport would need to add/relocate two stations and one airport would need to add/relocate three stations.

Figure 37: ICAO Three-Minute Runway End Demonstration at the Interviewed Airports

ICAO Three Minute-Response Time to Farthest Runway End								
Number of Airports Meeting ICAO Three Minute Response Time Demonstration to Reach Farthest Runway End From Existing ARFF Station(s)								
Can airport meet 3 and 4 minute response time?	Could fire station be relocated?	**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Yes	N/A	4	9	10	5	3	2	33
No	Yes	2		1	3			6
No	No	2	2	2	4	2	2	14
Total Airports Interviewed			**11**	**13**	**12**	**5**	**4**	**53**
Number of Additional or Relocated Airport Fire Stations Required to Meet Three-Minute Response Times to Farthest Runway End from Existing ARFF Station (s)								
Airports Requiring		**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
One Station		4	2	2	7	2	1	18
Two Stations		0	0	1	0	0	0	1
Three Stations		0	0	0	0	0	1	1
Total Airports		**4**	**2**	**3**	**7**	**2**	**2**	**20**
Additional or Relocated Stations		**4**	**2**	**4**	**7**	**2**	**4**	**23**

The results above have been expanded to provide an estimate of impacts for all Class I, II, and III Part 139 airports. Figure 38 shows the estimated number of fire stations, vehicles and firefighters needed to meet the ICAO three-minute response time requirements to the farthest runway end at the 476 airports, and include what would be required to meet the ICAO minimum vehicle standard. A total of 190 new/relocated fire stations and 283 ARFF vehicles would be needed, and these airports would have to add an additional 1,973 firefighters.

Figure 38: Impact of ICAO Three-Minute Response Time at 476 Airports

Estimated Impact of ICAO Three-Minute Runway Response Time (Assumes Satellite Stations)							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Airports Responding	8	11	13	12	5	4	53
Number of Airports in Group	99	131	111	78	33	24	476
Number of Additional Fire Stations	50	24	34	46	13	24	190
Number of Additional Vehicles	25	12	94	78	26	48	283
Number of Additional Firefighters	124	83	589	559	198	420	1,973

Satellite stations used for Index D and E airports.

Figure 39 shows the cost impact of these additional stations, vehicles and staffing for the airports. It is estimated that overall investment costs would be approximately $885 million for the 476 airports. The additional annual costs for operations, maintenance and depreciation are estimated to be $225.5 million. The average annual costs are about

$0.5 million with a range from about $0.1 million at Class IA, IIA and IIIA airports to $2.4 million at Class IE airports.

Figure 39: Estimated Costs of ICAO Three-Minute Response Time at 476 Airports

Estimated Cost of ICAO Three-Minute Runway Response Time Assuming Satellite Stations ($millions)							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Cost of Additional Stations*	$99.0	$47.6	$119.5	$273.0	$46.2	$84.0	**$669.4**
Cost of Additional Vehicles	$6.8	$3.3	$63.4	$62.4	$21.1	$38.4	**$195.4**
Firefighter Equipment and Training	$1.2	$0.8	$5.9	$5.6	$2.0	$4.2	**$19.7**
Total Initial Costs	**$107.0**	**$51.7**	**$188.8**	**$341.0**	**$69.3**	**$126.6**	**$884.5**
Station Utility and Maintenance Costs	$2.5	$1.2	$4.5	$7.8	$2.3	$4.2	**$22.5**
Additional Vehicle O&M Costs	$0.3	$0.2	$3.2	$3.1	$1.1	$1.9	**$9.8**
Firefighter Salaries and Benefits	$7.2	$6.1	$41.2	$44.4	$19.1	$44.7	**$162.6**
Recurring Equipment and Training	$0.2	$0.2	$1.2	$1.1	$0.4	$0.8	**$3.9**
Vehicle Annual Investment Cost	$0.4	$0.2	$3.8	$3.7	$1.3	$2.3	**$11.7**
Building Annual Investment Cost	$3.3	$1.6	$4.0	$9.1	$1.5	$2.8	**$22.3**
Total Annual Operating and Depreciation Costs	**$14.0**	**$9.4**	**$57.8**	**$69.3**	**$25.6**	**$56.7**	**$232.8**
Average Annual Total Costs Per Airport	**$0.1**	**$0.1**	**$0.5**	**$0.9**	**$0.8**	**$2.4**	**$0.5**

*Relocated fire stations produce investment costs, but require no additional staffing or vehicles.

Figure 40 shows the impact on cost per enplaned passengers of the ICAO three-minute response time standard for each of the airport groups. The largest dollar and percentage impacts are at Class IIA and IIIA airports, where there is an 13 percent increase in the cost per enplanement. The costs are minimal at Class ID and IE airports. As can be seen, over one-half of the airports reported no cost increase.

Figure 40: Cost per Enplanement of ICAO Three-Minute Response Time at the Interviewed Airports

ICAO Three-Minute Runway Response Time Assuming Satellite Stations						
Airports Responding and Activity Data				Operating and Annual Investment Costs		
Class/Index	Number of Airports	Number of Airports with Zero Increased Cost	Enplanements	Current Cost Per Enplanement	Increase per Enplanement	% Increase
IIIA/IIA	7	3	127,684	$68.24	$8.87	13.0%
IA	11	9	474,996	$88.73	$1.66	1.9%
IB	13	5	3,734,739	$35.55	$1.81	5.1%
IC	12	5	31,743,879	$26.38	$0.34	1.3%
ID	5	3	40,388,193	$24.07	$0.10	0.4%
IE	4	2	113,603,852	$19.15	$0.08	0.4%

The cost per enplanement by group can differ based on the number of airports responding.

NFPA STANDARDS

Like ICAO, NFPA also has standards for the minimum number of ARFF vehicles; however, NFPA also has standards for the minimum number of firefighters at various

classes of airports. In addition, NFPA has multiple response time demonstration requirements, one for reaching the end of the farthest runway and another for reaching any point on the taxiways, ramp and apron.

NFPA Minimum Requirements for ARFF Staffing and Vehicles

As shown above in Sections 2.5.3 and 2.5.5, NFPA has standards for the minimum numbers of ARFF vehicles and staffing for each airport group. In general, NFPA requires an additional ARFF vehicle when compared to Part 139; however, many airports already have more than the minimum numbers of vehicles required by FAA. Figure 41 shows that the NFPA standard for vehicles would require an additional 132 vehicles, and these needs are concentrated at Class IA and IB airports. The NFPA minimum staffing requirement impacts all classes of airports. This ranges from four additional firefighters at Class IIA and IIIA airports to over 20 additional firefighters at Class IB and IC airports.

Figure 41: Vehicles and Firefighters Needed to Meet NFPA Minimums at 476 Airports

Estimated Impact of NFPA Minimum Staff/Vehicles Requirement							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Airports Responding	8	11	13	12	5	4	**53**
Number of Airports in Group	99	131	111	78	33	24	**476**
Number of Additional Fire Stations	0	0	0	0	0	0	**0**
Number of Additional Vehicles	0	60	60	13	0	0	**132**
Number of Additional Firefighters	371	1,691	3,057	1,950	363	210	**7,642**
Average No. of Added Firefighters Per Airport	**4**	**13**	**28**	**25**	**11**	**9**	**16**

Satellite stations used for Index D and E airports.

The estimated acquisition and operating costs for the additional firefighters and vehicles are shown in Figure 42. The initial costs of the vehicles are estimated at $67.1 million, while the cost of firefighter equipment and initial training are $76.4 million. The largest costs are firefighter salaries and benefits, at $545.7 million per year. The total estimated annual cost increases at Class I, II, and III airports are $568 million, or an average of about $1.2 million per airport. The largest increases in average costs are at Class IB and IC airports.

Figure 42: Estimated Costs of NFPA Minimum Firefighter and Vehicle Standards at 476 Airports

Estimated Cost of NFPA Minimum Staff/Vehicles Requirement in $ Millions							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Cost of Additional Stations*	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	**$0.0**
Cost of Additional Vehicles	$0.0	$16.4	$40.3	$10.4	$0.0	$0.0	**$67.1**
Firefighter Equipment and Training	$3.7	$16.9	$30.6	$19.5	$3.6	$2.1	**$76.4**
Total Initial Costs	**$3.7**	**$33.3**	**$70.9**	**$29.9**	**$3.6**	**$2.1**	**$143.5**
Station Utility and Maintenance Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	**$0.0**
Additional Vehicle O&M Costs	$0.0	$0.8	$2.0	$0.5	$0.0	$0.0	**$3.4**
Firefighter Salaries and Benefits	$20.9	$111.3	$205.5	$145.1	$45.7	$17.2	**$545.7**
Recurring Equipment and Training	$0.7	$3.4	$6.1	$3.9	$0.7	$0.4	**$15.3**
Vehicle Annual Investment Cost	$0.0	$1.0	$2.4	$0.6	$0.0	$0.0	**$4.0**
Building Annual Investment Cost	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	**$0.0**
Total Annual Operating and Depreciation Costs	**$21.6**	**$116.4**	**$216.0**	**$150.2**	**$46.5**	**$17.6**	**$568.3**
Average Annual Total Costs Per Airport	**$0.2**	**$0.9**	**$1.9**	**$1.9**	**$1.4**	**$0.7**	**$1.2**

*Relocated fire stations produce investment costs, but require no additional staffing or vehicles.

Figure 43 shows the impact on cost per enplaned passengers of the NFPA minimum firefighter and vehicle standards for each of the airport groups. As can be seen, the increase is approximately 20 percent for Class IA, IB, IIA and IIIA airports. There are ten airports with no cost increase from this standard.

Figure 43: Cost per Enplanement of NFPA Minimum Firefighter and Vehicle Standards at the Interviewed Airports

NFPA Minimum Staffing and Vehicle Requirement						
Airports Responding and Activity Data				Operating and Annual Investment Costs		
Class/Index	Number of Airports	Number of Airports with Zero Increased Cost	Enplanements	Current Cost Per Enplanement	Increase per Enplanement	% Increase
IIIA/IIA	7	3	127,684	$68.24	$13.67	20.0%
IA	11	1	474,996	$88.73	$20.58	23.2%
IB	13	1	3,734,739	$35.55	$6.77	19.1%
IC	12	0	31,743,879	$26.38	$0.73	2.8%
ID	5	2	40,388,193	$24.07	$0.17	0.7%
IE	4	3	113,603,852	$19.15	$0.03	0.1%

The cost per enplanement by group can differ based on the number of airports responding.

NFPA Two Minute Runway Response Time

NFPA has response time standards for both runways and taxiways/aprons. The airport is required to demonstrate that the first vehicle can reach the farthest runway end within two minutes during good visibility and surface conditions. The airports reported how many additional ARFF stations would be needed if the NFPA standards

applied. Figure 44 shows that only four of the 47 airports that replied could meet a demonstrated two-minute response time standard. Nine respondents said that an existing fire station could be relocated, while 34 airports reported new stations would have to be built. The bottom half of this figure shows how many stations would have to be added at airports. In total, the respondents indicated that 66 additional or relocated fire stations would be required to meet the NFPA two-minute demonstration.

Figure 44: NFPA Two-Minute Runway End Demonstration at the Interviewed Airports

NFPA Two-Minute Response to Farthest Runway End								
Number of Airports Meeting NFPA Two-Minute Response Time Demonstration								
Can airport meet two-minute response time?	Could fire station be relocated?	**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Yes	N/A	1	1	2				4
No	Yes	3	5	1				9
No	No	3	5	6	12	4	4	34
Total for Analysis		**7**	**11**	**9**	**12**	**4**	**4**	**47**
No	No Response			2				2
No	Impossible to meet	1						1
No Response	No Response			2		1		3
Total		**8**	**11**	**13**	**12**	**5**	**4**	**53**
Number of Additional or Relocated Fire Stations Required to Meet Two-Minute Response Time								
Airports Requiring		**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
One Station		6	9	5	6	2		28
Two Stations			1	2	6	1	1	11
Three Stations						1	1	2
Four Stations							1	1
Five Stations								0
Six Stations							1	1
Total Airports Interviewed		**6**	**10**	**7**	**12**	**4**	**4**	**43**
Additional or Relocated Stations		**6**	**11**	**9**	**18**	**7**	**15**	**66**

Figure 45 shows the total number of stations, vehicles and firefighters that would be needed at the 476 airports to meet the NFPA two-minute response requirement, as well as the average number per airport. (These estimates also include what would be needed to meet the NFPA minimum staffing and vehicle requirements.) A total of 592 new or relocated stations would be needed or an average of about one per airport. Some of the larger airports will require multiple stations (these are assumed to be satellite stations at Index D and E airports). A total of 1,018 new vehicles would be required; this is an average of about two per airport with the number increasing with the size of the existing ARFF presence. The additional stations and vehicles would require an estimated 11,047 additional firefighters, or an average of 23 per airport. As can be seen, the

average number of additional firefighters ranges from five at Class IIA and IIIA airports to 70 at Class IE airports.

Figure 45: Impact of NFPA Two-Minute Response Time at 476 Airports

Estimated Impact of NFPA Two-Minute Runway Response Time Assuming Satellite Stations							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Airports Responding	7	11	9	12	4	4	**47**
Number of Airports in Group	99	131	111	78	33	24	**476**
Number of Additional Fire Stations	85	131	111	117	58	90	**592**
Number of Additional Vehicles	42	107	222	351	116	180	**1,018**
Number of Additional Firefighters	509	1,905	3,244	2,802	908	1,680	**11,047**
Average No. of Added Fire Stations Per Airport	**1**	**1**	**1**	**2**	**2**	**4**	**1**
Average No. of Added Vehicles Per Airport	**0**	**1**	**2**	**5**	**4**	**8**	**2**
Average No. of Added Firefighters Per Airport	**5**	**15**	**29**	**36**	**28**	**70**	**23**

Satellite stations used for Index D and E airports.

Figure 46 shows the estimated costs of the NFPA two minute standard. The 592 additional stations are estimated to cost $2.0 billion and the 1,018 vehicles are estimated to cost $708 million. Some of these costs may be eligible for AIP grants. The total investment costs are estimated to average $6 million per airport, with a range of from about $2 million to $20 million depending on the size of the airport. The largest increase in annual operating cost is $776.3 million for additional firefighters. The average total cost including annualized investment costs, are about $2.2 million per airport, with a range of from $0.4 million to $8 million per airport.

Figure 46: Estimated Costs of NFPA Two-Minute Response Time at 476 Airports

Estimated Cost of NFPA Two-Minute Runway Response Time Assuming Satellite Stations ($ millions)							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Cost of Additional Stations*	$169.7	$262.0	$388.5	$702.0	$202.1	$315.0	**$2,039.3**
Cost of Additional Vehicles	$11.7	$29.5	$149.8	$280.8	$92.4	$144.0	**$708.2**
Firefighter Equipment and Training	$5.1	$19.1	$32.4	$28.1	$9.1	$16.8	**$110.6**
Total Initial Costs	**$186.5**	**$310.5**	**$570.8**	**$1,010.9**	**$303.6**	**$475.8**	**$2,858.1**
Average Initial Cost Per Airport	**$1.9**	**$2.4**	**$5.1**	**$13.0**	**$9.2**	**$19.8**	**$6.0**
Station Utility and Maintenance Costs	$4.2	$7.1	$17.3	$35.1	$10.1	$15.8	**$89.6**
Additional Vehicle O&M Costs	$0.6	$1.5	$7.5	$14.0	$4.6	$7.2	**$35.4**
Firefighter Salaries and Benefits	$28.6	$126.0	$207.6	$201.3	$66.6	$146.2	**$776.3**
Recurring Equipment and Training	$1.0	$3.8	$6.5	$5.6	$1.8	$3.4	**$22.1**
Vehicle Annual Investment Cost	$0.7	$1.8	$9.0	$16.8	$5.5	$8.6	**$42.5**
Building Annual Investment Cost	$5.7	$8.7	$12.9	$23.4	$6.7	$10.5	**$68.0**
Total Annual Operating and Depreciation Costs	**$40.8**	**$148.9**	**$260.8**	**$296.3**	**$95.5**	**$191.6**	**$1,033.9**
Average Annual Total Costs Per Airport	**$0.4**	**$1.1**	**$2.3**	**$3.8**	**$2.9**	**$8.0**	**$2.2**

*Relocated fire stations produce investment costs, but require no additional staffing or vehicles.

Figure 47 shows the impact on cost per enplaned passengers of the NFPA two-minute response time standard for each of the airport groups. The largest percentage increases are for the airport groups with relatively few enplanements. The increase in cost exceeds $25 per enplanement at Class IA, IIA and IIIA airports. There is a 39.7 percent increase at Class IIA and IIIA airports and the increase is over 20 percent at Class IA and IB airports. All airports interviewed reported cost increases for this standard.

Figure 47: Cost per Enplanement of NFPA Two-Minute Response Time at the Interviewed Airports

NFPA Two-Minute Runway Response Time Assuming Satellite Stations						
Airports Responding and Activity Data				Operating and Annual Investment Costs		
Class/Index	Number of Airports	Number of Airports with Zero Increased Cost	Enplanements	Current Cost Per Enplanement	Increase per Enplanement	% Increase
IIIA/IIA	6	0	104,095	$69.74	$27.72	39.7%
IA	11	0	474,996	$88.73	$26.33	29.7%
IB	9	0	2,679,997	$34.48	$7.89	22.9%
IC	12	0	31,743,879	$26.38	$1.44	5.4%
ID	4	0	30,924,304	$25.99	$0.37	1.4%
IE	4	0	113,603,852	$19.15	$0.28	1.5%

The cost per enplanement by group can differ based on the number of airports responding.

NFPA Three Minute Movement Area Requirement

Figure 48 shows the number of airports that could meet the requirement to demonstrate that ARFF can respond within three minutes to any point on the airport movement area, including taxiways, ramps and aprons. A total of 20 airports could not meet this requirement, and in most cases an existing fire station could not be relocated on the airport to meet the requirement. There is one airport that cannot add a station due to lack of space on airport property. The bottom half of Figure 48 shows the number of fire stations needed to meet this requirement. A total of 29 new (additional or relocated) stations are needed. At two thirds of the airports, only one additional fire station would be needed, but one airport would require four additional stations.

Figure 48: NFPA Three-Minute Taxiway-Ramp Demonstration at the Interviewed Airports

NFPA Three-Minute Response to Any Point on Taxiway and Ramp								
No. of Airports Meeting Taxiway-Ramp Three-Minute Response Time								
Can airport meet 3-minute response time?	Could fire station be relocated?	**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Yes	N/A	5	9	9	6	1	1	31
No	Yes	2		1	1	1		5
No	No		2	3	5	2	3	15
Total for Analysis		**7**	**11**	**13**	**12**	**4**	**4**	**51**
No	Impossible to meet	1						1
No Response	No Response						1	1
Total Airports Interviewed		**8**	**11**	**13**	**12**	**4**	**5**	**53**
Number of Additional or Relocated Fire Stations Required to Meet Three-Minute Taxiway-Ramp Response Time Demonstration								
Airports Requiring		**Airport ARFF Classification**						
		IIIA/IIA	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
One Station		2	2	3	5	3		15
Two Stations				1	1			2
Three Stations							2	2
Four Stations							1	1
Total Airports		**2**	**2**	**4**	**6**	**3**	**3**	**20**
Additional or Relocated Stations		**2**	**2**	**5**	**7**	**3**	**10**	**29**

Figure 49 shows the total number of stations, vehicles and firefighters that would be needed at the 476 airports to meet the NFPA three-minute response requirement to any point on the taxiway, ramp and apron, as well as the average number per airport. These estimates include what would be needed to meet the NFPA minimum staffing and vehicle requirements. A total of 225 new or relocated stations would be needed, or an average of less than one per airport. Some of the larger airports will require multiple stations (these are assumed to be satellite stations at Index D and E airports). A total of 450 new vehicles would be required, an average of about one per airport (with the number increasing with the size of the existing ARFF presence). The additional stations and vehicles would require an estimated 8,694 additional firefighters, or an average of 18 per airport.

Figure 49: Impact of NFPA Three-Minute Response Time at 476 Airports

Estimated Impact of NFPA Three-Minute Movement Area Response Time Assuming Satellite Stations							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Number of Airports Responding	7	11	13	12	4	4	**51**
Number of Airports in Group	99	131	111	78	33	24	**476**
Number of Additional Fire Stations	28	24	43	46	25	60	**225**
Number of Additional Vehicles	0	71	102	124	33	120	**450**
Number of Additional Firefighters	283	1,870	3,099	2,152	330	960	**8,694**
Average No. of Added Fire Stations Per Airport	< 1	< 1	< 1	1	1	3	< 1
Average No. of Added Vehicles Per Airport	0	1	1	2	1	5	1
Average No. of Added Firefighters Per Airport	3	14	28	28	10	40	18

Satellite stations used for Index D and E airports.

Figure 50 shows the estimated costs of the NFPA three-minute response time standard. The 225 additional stations are estimated to cost $823.3 million and the 450 vehicles are estimated to cost $310 million. Some of these capital costs may be eligible for funding from AIP. The total investment costs are estimated to average $2.6 million per airport, and range from about $0.6 million to $13.2 million depending on the size of the airport's ARFF operation. The largest annual operating cost is $635.4 million for additional firefighters. The average annual total cost, including annualized investment costs, is about $1.6 million per airport, with a range from $0.1 million to $5 million per airport.

Figure 50: Estimated Costs of NFPA Three-Minute Response at 476 Airports

Estimated Cost of NFPA Three-Minute Movement Area Response Time Assuming Satellite Stations ($ millions)							
Airport Class	**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
Cost of Additional Stations*	$56.6	$47.6	$149.4	$273.0	$86.6	$210.0	**$823.3**
Cost of Additional Vehicles	$0.0	$19.6	$69.2	$98.8	$26.4	$96.0	**$310.0**
Firefighter Equipment and Training	$2.8	$18.7	$31.0	$21.5	$3.3	$9.6	**$86.9**
Total Initial Costs	**$59.4**	**$86.0**	**$249.6**	**$393.3**	**$116.3**	**$315.6**	**$1,220.2**
Average Initial Cost Per Airport	**$0.6**	**$0.7**	**$2.2**	**$5.0**	**$3.5**	**$13.2**	**$2.6**
Station Utility and Maintenance Costs	$0.0	$2.4	$6.0	$11.7	$2.9	$10.5	**$33.4**
Additional Vehicle O&M Costs	$0.0	$1.0	$3.5	$4.9	$1.3	$4.8	**$15.5**
Firefighter Salaries and Benefits	$13.2	$123.0	$207.4	$162.6	$39.8	$89.3	**$635.4**
Recurring Equipment and Training	$0.6	$3.7	$6.2	$4.3	$0.7	$1.9	**$17.4**
Vehicle Annual Investment Cost	$0.0	$1.2	$4.1	$5.9	$1.6	$5.8	**$18.6**
Building Annual Investment Cost	$1.9	$1.6	$5.0	$9.1	$2.9	$7.0	**$27.4**
Total Annual Operating and Depreciation Costs	**$15.7**	**$132.9**	**$232.2**	**$198.6**	**$49.2**	**$119.3**	**$747.8**
Average Annual Total Costs Per Airport	**$0.2**	**$1.0**	**$2.1**	**$2.5**	**$1.5**	**$5.0**	**$1.6**

*Relocated fire stations produce investment costs, but require no additional staffing or vehicles.

Figure 51 shows the impact on cost per enplaned passengers of the NFPA three-minute response time standard for each of the airport groups. As can be seen, the cost increase is in excess of 20 percent at Class IA and IB airports. Only three of the interviewed airports said they would not face increased costs.

Figure 51: Cost per Enplanement of NFPA Three-Minute Response at the Interviewed Airports

NFPA Three-Minute Movement Area Response Time Assuming Satellite Stations						
Airports Responding and Activity Data				Operating and Annual Investment Costs		
Class/Index	Number of Airports	Number of Airports with Zero Increased Cost	Enplanements	Current Cost Per Enplanement	Increase per Enplanement	% Increase
IIIA/IIA	6	2	104,095	$69.74	$10.64	15.2%
IA	11	0	474,996	$88.73	$23.49	26.5%
IB	13	0	3,734,739	$35.55	$7.28	20.5%
IC	12	0	31,743,879	$26.38	$0.96	3.6%
ID	4	0	30,924,304	$25.99	$0.19	0.7%
IE	4	1	113,603,852	$19.15	$0.18	0.9%

The cost per enplanement by group can differ based on the number of airports responding.

OTHER COST IMPACTS

One of the larger potential cost impacts reported during the interviews was the NFPA rapid response area requirement. At many airports substantial investments would have to be made to make the RRA accessible; however, airports were not able to provide estimates of these costs. The likely magnitude of these costs are addressed below. In addition, the interviews also requested information on the costs for firefighting drills, full-scale exercises of emergency plans and tabletop exercises. However, the responses to these questions varied greatly and the costs were not of a sufficient magnitude to include in the analysis above.

Rapid Response Area

Although an airport may own the land beyond the FAA-required runway safety area (RSA), it is often a major undertaking to make this area accessible to ARFF vehicles so that they can respond within 2½ minutes as required by the NFPA standards for a Rapid Response Area (RRA). For example, an airport may be on a mesa with a large drop-off beyond the RSA. Alternatively, there are situations where a major roadway is located beyond the RSA but within the RRA. Such a roadway may be a state, county, or city road with airport-owned land on either side of it. In other cases, wetlands located on airport property may preclude making the RRA accessible. However, under NFPA standards the RRA includes (and is limited to) land that is on the airport property.

During the interviews, several fire chiefs expressed concern about the ability to drive at any appreciable speed on non-paved surfaces in the RRA. Assuming that an

ARFF vehicle could reach the runway end in two minutes (in line with the NFPA standard), it would than need to travel another 1,650 feet to reach the end of the RRA within the remaining 30 seconds provided for in the NFPA standard. Figure 52 shows the time needed to travel 1,650 feet at various speeds; a vehicle would have to travel at 37.5 mph to cover this distance in 30 seconds. While this is within the range of speeds for ARFF vehicles operating on the airport property reported during the interviews, several fire chiefs noted that it would not be prudent to travel at this speed on unprepared surfaces.

Figure 52: Vehicle Speed and Response Time-Distance

Vehicle Speed	Time to Travel 1,650 feet
60 mph	18.75 seconds
45 mph	25 seconds
37.5 mph	30 seconds
30 mph	37.5 seconds
15 mph	75 seconds

Figure 53 shows the accessibility of the current rapid response areas (RRAs) for the 129 runways located at the 53 airports that were interviewed. As can be seen, the RRAs for almost half the runways are accessible with no further work required, although this should not be interpreted to mean that ARFF vehicles could respond within the required 2½ minutes. Major work would be required to make the RRAs accessible for a large number (40 percent) of runways (irrespective of the exact response time requirement). Finally, it is not possible to make the RRAs accessible for approximately four percent of the runways.

Figure 53: Distribution of RRA Accessibility for 129 Runways at Interviewed Airports

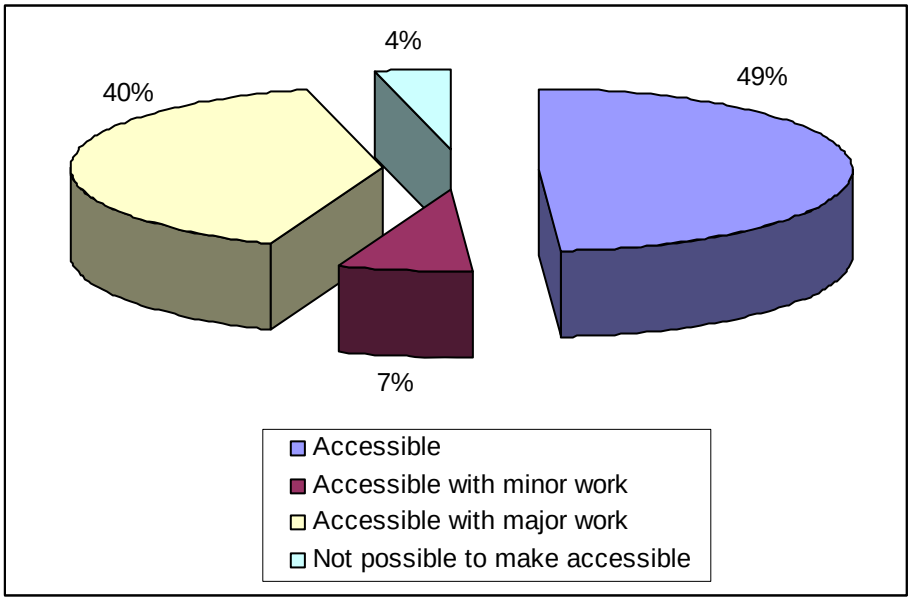


Figure 54 shows the number of RRAs that are accessible in terms of meeting a 2½-minute accessibility requirement. Almost 75 percent of the RRAs at the airports interviewed (95 of 129 runways) cannot meet the 2½-minute accessibility requirement as configured today. In discussions with airports about the costs of the work necessary to make these areas accessible, only a few airports were willing to provide rough estimates. These costs are very airport specific and depend on topography, existing roads and a number of other factors.

Figure 54: Rapid Response Area 2.5-Minute Accessibility at the Interviewed Airports

Count of Runways	3A	2A	1A	1B	1C	1D	1E	Total
Accessible	0	2	8	5	4	2	13	34
Not Accessible	4	9	14	20	26	13	9	95
Total	**4**	**11**	**22**	**25**	**30**	**15**	**22**	**129**

Percentages								
Percentage of Runways	**3A**	**2A**	**1A**	**1B**	**1C**	**1D**	**1E**	**Total**
Accessible	0%	18%	36%	20%	13%	13%	59%	26%
Not Accessible	100%	82%	64%	80%	87%	87%	41%	74%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

To give some indication of the potential magnitude of these costs, two factors must be considered. First, there are 52 runways that need major work to make the RRA accessible. There are data on the amount of AIP grants provided to improve airport

Runway Safety Areas (RSAs) over the last few years, a project somewhat comparable in scope. In one region these grants ranged from $3 million to $10 million. FAA also reports that it plans to spend about $1.1 billion to improve 168 airport runway safety areas by the year 2015. This implies an average cost of about $6.5 million per RSA. Second, some of these runways cannot meet the 2½ -minute accessibility standard in NFPA, even after they are improved. In these cases it will require that fire stations be relocated or additional fire stations be added at the airport. Thus, RRA accessibility costs could be significant for some airports, but it would require more formal engineering analyses to develop reliable cost estimates.

Other

Frequency of Full-Scale Emergency Exercise--Information was collected on the costs associated with holding a full-scale emergency exercise during the airport interviews. However, the information collected was not consistent from one airport to the next, i.e., some included their labor costs while others did not, some included exercise planning costs while others only included their out of pocket costs such as supplying lunches to the drill participants. Most airport operators did not have good information on what it cost the surrounding communities to participate in the planning meetings and the actual exercises.

Typical costs include the time spent at meetings to plan the exercise. It is not unusual for this to require several meetings with 15 to 20 people involved for a medium size airport. In addition to the cost of labor hours expended in participating in the drill, there is a need to maintain airport operations, hospital services, municipal fire department responses, etc. These often require bringing people in on overtime to provide backup services, and these costs can easily reach the five-figure dollar level.

Changing the frequency of full-scale emergency exercises from the current FAA requirement of once every three years to the ICAO/NFPA requirement of once every two years increases the cost of each participating agency by 50 per cent. During the interviews some of the airport operators expressed concern that some of the surrounding community organizations would cut back on their participation because of the increased costs. If such cutbacks occurred it would defeat the whole purpose of having the drill, i.e., to demonstrate a coordinated community response to an emergency.

ARFF Services Provided by the Military--Military units, typically Air National Guard, are located on some civilian airports. Their national defense mission often requires that they have ARFF services available to respond to emergencies by military aircraft. When military ARFF services are on the airport, the civil airport authority and the military usually enter into an agreement where the military provides ARFF services for civilian aircraft. In turn landing fees and lease fees are waived for the military.

There are approximately 40 airports with Part 139 certificates that have this type of arrangement.

Four of the 53 airports interviewed had ARFF services provided by the military and the costs and levels of current ARFF services associated with these operations were included in our analysis. However, if civilian ARFF requirements exceeded those required by military's mission, it is not known whether the military would still provide these services. For example, if an additional ARFF station were required to meet reduced response times for the civil operation, would the military be willing to build, staff and equip such a fire house? If not, the airport would incur these costs.

POTENTIAL COST IMPACTS ON AIRPORTS

As shown above, the impacts of NFPA and ICAO ARFF standards on airports derive from the numbers of firefighters, vehicles and fire stations that would have to be added under the various ICAO and NFPA standards. Figure 55 shows the numbers of vehicles and firefighters estimated for the current baseline and the added firefighters and vehicles for the five scenarios analyzed in Section 5.3. As shown, the NFPA two-minute response requirement is estimated to double the number of firefighters and vehicles at 476 airports. The analysis below also summarizes the changes in costs both in absolute terms for the 476 airports and on the cost per enplaned passenger at the sample of airports.

Figure 55: Summary of Baseline Firefighters and Vehicles Required to Meet ICAO and NFPA Standards at 476 Airports

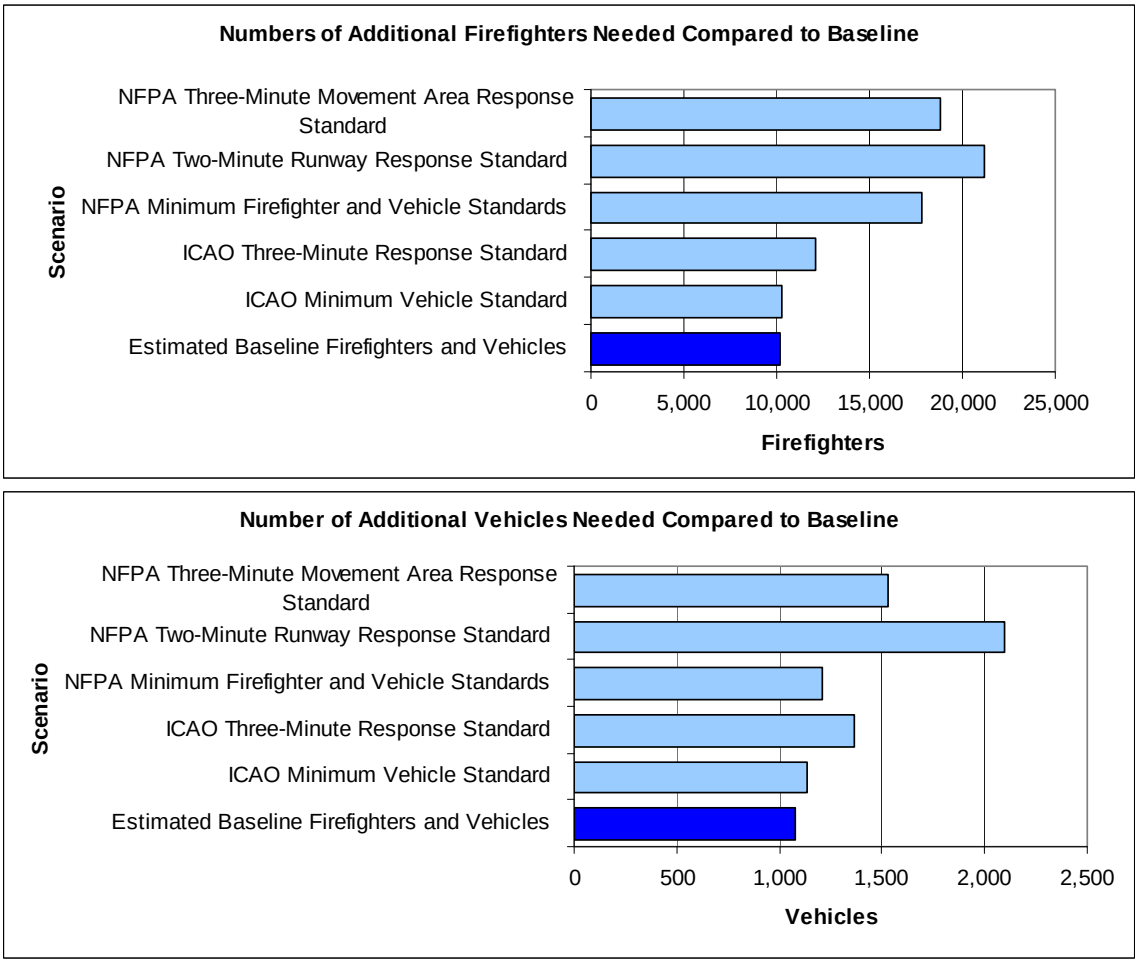


Figure 56 summarizes the cost impacts of the ICAO and NFPA standards using the total costs and average costs per airport for each class. These cost estimates for the runway response time requirements include the staffing and vehicles added to meet minimum ICAO and NFPA requirements. As can be seen NFPA standards have a higher cost impact than the ICAO ones, and the NFPA two-minute demonstrated response time to the runway end has the highest costs of the these standards. The ICAO minimum vehicle requirements have a relatively small impact and affect only Class IB airports, while NFPA minimum vehicle and staffing requirements are much larger and affect all airport groups. In general, the average cost per airport is higher for those groups with a larger baseline ARFF presence.

Figure 56: Summary of Costs for ICAO and NFPA Standards at 476 Airports

Summary of Annual Coat Impacts of ICAO and NFPA Standards ($ millions)					
Total Annual Operating and Depreciation Costs					
Airport Class	**ICAO**		**NFPA**		
	Vehicle Minimum	Three-Minute	Staff/Vehicle Minimum	Two-Minute	Three-Minute
IIIA/IIA	$0.0	$14.0	$21.6	$40.8	$15.7
IA	$0.0	$9.4	$116.4	$148.9	$132.9
IB	$16.5	$57.8	$216.0	$260.8	$232.2
IC	$0.0	$69.3	$150.2	$296.3	$198.6
ID	$0.0	$25.6	$46.5	$95.5	$49.2
IE	$0.0	$56.7	$17.6	$191.6	$119.3
All	**$16.5**	**$232.8**	**$568.3**	**$1,033.9**	**$747.8**
Average Annual Operating and Depreciation Costs					
Airport Class	**ICAO**		**NFPA**		
	Vehicle Minimum	Three-Minute	Staff/Vehicle Minimum	Two-Minute	Three-Minute
IIIA/IIA	$0.0	$0.1	$0.2	$0.4	$0.2
IA	$0.0	$0.1	$0.9	$1.1	$1.0
IB	$0.1	$0.5	$1.9	$2.3	$2.1
IC	$0.0	$0.9	$1.9	$3.8	$2.5
ID	$0.0	$0.8	$1.4	$2.9	$1.5
IE	$0.0	$2.4	$0.7	$8.0	$5.0
All	**$0.0**	**$0.5**	**$1.2**	**$2.2**	**$1.6**

Note: the costs of minimum vehicle and staff requirements are included in the response time estimates.

Figure 57 shows the change in cost per enplaned passenger under the ICAO standards for each airport class/index group. These include operating and annual investment costs, and are measured in terms of the increase in ARFF costs in relation to the total costs. As can be seen, the ICAO minimum vehicles standard impacts only Class IB airports and the percentage increase is small. The ICAO three-minute response to the farthest runway end increases costs per enplaned passengers for all airport groups, with the largest absolute and percentage increase at Class IIA and IIIA airports.

Figure 57: Summary Cost per Enplaned Passenger—ICAO Standards at the Interviewed Airports

Annual Cost per Enplaned Passenger						
Class/Index	ICAO Vehicle Minimum			ICAO Three-Minute		
	Current	Increase	Percent Increase	Current	Increase	Percent Increase
IIIA/IIA	$68.24	$0.00	0.0%	$69.74	$8.87	13.0%
IA	$88.73	$0.00	0.0%	$88.73	$1.66	1.9%
IB	$35.55	$0.52	1.5%	$34.48	$1.81	5.1%
IC	$26.38	$0.00	0.0%	$26.38	$0.34	1.3%
ID	$24.07	$0.00	0.0%	$25.99	$0.10	0.4%
IE	$19.15	$0.00	0.0%	$19.15	$0.08	0.4%

The current cost by group can differ based on the number of airports responding.

Figure 58 shows the changes in cost per enplaned passenger for the NFPA standards. The increases in costs per enplaned passenger from the NFPA minimum firefighters and vehicle standards at Index A and B airports are generally more than twenty percent. For the larger airports (Index D and E), these increases are much smaller. Overall, the increase in cost per enplaned passenger is largest for the NFPA two-minute runway response demonstration standard. The impacts on the smaller airports (Class I, II and III, Index A) are higher in terms of both the absolute cost per enplaned passenger as well as in the percentage increase. The NFPA three-minute standard has somewhat lower costs, although the increases at Class IA and IB airports exceed 20 percent. The level of costs estimated for Class IIA and IIIA airports may be affected by a change in the number of airports that responded to this question.

Figure 58: Summary Cost per Enplaned Passenger—NFPA Standards at the Interviewed Airports

Annual Cost per Enplaned Passenger									
Class/Index	NFPA Staff/Vehicle Minimum			NFPA Two-Minute			NFPA Three-Minute		
	Current	Increase	Percent Increase	Current	Increase	Percent Increase	Current	Increase	Percent Increase
IIIA/IIA	$68.24	$13.67	20.0%	$69.74	$27.72	39.7%	$69.74	$10.64	15.2%
IA	$88.73	$20.58	23.2%	$88.73	$26.33	29.7%	$88.73	$23.49	26.5%
IB	$35.55	$6.77	19.1%	$34.48	$7.89	22.9%	$35.55	$7.28	20.5%
IC	$26.38	$0.73	2.8%	$26.38	$1.44	5.4%	$26.38	$0.96	3.6%
ID	$24.07	$0.17	0.7%	$25.99	$0.37	1.4%	$25.99	$0.19	0.7%
IE	$19.15	$0.03	0.1%	$19.15	$0.28	1.5%	$19.15	$0.18	0.9%

The current cost by group can differ based on the number of airports responding.

SUMMARY

As can be seen from the above analysis, adoption of ICAO and/or NFPA standards would increase ARFF costs at airports. These increases are most pronounced at some of the smallest airports (Class I and II Index A). The three-minute ICAO standard is less costly than the two-minute NFPA standard to runway ends and the three-minute NFPA standard for the movement area.

Airport operating and investment costs per passenger are much higher at smaller airports. The cost increase per enplaned passenger due to new ARFF standards would be high in both absolute terms and as a cost per enplaned passenger at these airports. This is due to both the relatively low number of enplanements, but is also affected by the minimum costs of providing enhanced ARFF services. The total increase in costs would be highest at the largest airports because they have the greatest numbers of runways, which require the most ARFF infrastructure. Finally, the data gathered did not permit us to make an estimate of the costs needed to make the on-airport RRA specified by NFPA fully accessible to ARFF vehicles.

Figure 59 summarizes the estimated investment cost (primarily for new fire stations and ARFF vehicles) and operating cost (largely for additional firefighters) impacts of the ICAO and NFPA standards for the 476 Class I, II, and III airports. While the minimum vehicle (ICAO and NFPA) and firefighter standards have relatively low initial costs, the annual operating and depreciation costs of the NFPA minimum vehicle and firefighter standard are $568.3 million. The ICAO three-minute runway response has initial costs of $884.5 million and recurring costs of $232.8 million (including the annualized initial costs). The NFPA two-minute runway response standard has the highest costs, with initial costs of $2.9 billion and annual operating and depreciation costs of $1.0 billion. The NFPA three-minute response to taxiways, ramps and aprons (maneuvering area) has initial costs of $1.2 billion and annual operating and depreciation costs of $747.8 million.

Figure 59: Summary Cost Impacts of ICAO and NFPA Standards at 476 Airports ($millions)

Standard	Total Initial Costs	Annual Operating and Depreciation Costs
ICAO Minimum Vehicles	$36.3	$16.5
ICAO Three-Minute Runway Response	$884.5	$232.8
NFPA Minimum Firefighters and Vehicles	$143.5	$568.3
NFPA Two-Minute Runway Response	$2,858.1	$1,033.9
NFPA Three Minute Maneuvering Area Response	$1,220.2	$747.8

Note: Response standard estimates include meeting minimum standards for vehicles and firefighters, as appropriate.

In summary, it must be noted that the cost estimates contained in the report are based on the stated differences in the FAA, ICAO, and NFPA standards. The actual increase in ARFF costs experienced by any airport would be based on the specific changes to Part 139, because FAA has the latitude to adopt all, some or none of the other industry standards. These changes would be subject to the normal requirements of agency rule making.

LIST OF ACRONYMS

AC—FAA Advisory Circular

ACRP—Airport Cooperative Research Program

AIP—FAA Airport Improvement Program

ARFF—airport rescue and fire fighting

CFR—Code of Federal Regulations

CPE—cost per enplaned passenger

FAA—Federal Aviation Administration

HAZMAT—hazardous materials

NFPA—National Fire Protection Association

NPRM—notice of proposed rulemaking

NTSB—National Transportation Safety Board

ICAO—International Civil Aviation Organization

RRA—rapid response area

RSA—runway safety area

SARPs—standards and recommended practices

WMD—weapons of mass destruction

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APPENDIX A
PART 139 CERTIFICATION STATUS TABLE

The airport classifications listed below are PRELIMINARY and SUBJECT TO CHANGE. Please coordinate with your Regional Airports Office to ensure your airport has the appropriate airport classification in accordance with the revised Part 139.

Last Update: 2/9/2009

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Alabama	Anniston Metro	Anniston	ANB	NA		Class IV	A
	Talladega Muni	Talladega	ASN	NA		Class IV	A
	Mobile Downtown	Mobile	BFM	NA		Class IV	A
	Birmingham Int'l	Birmingham	BHM	Sm		Class I	C
	Dothan	Dothan	DHN	Non		Class I	B
	Huntsville Int'l	Huntsville	HSV	Sm		Class I	C
	Dannelly Fld	Montgomery	MGM	Non		Class I	B
	Mobile Reg	Mobile	MOB	Non		Class I	C
	Muscle Shoals Reg	Muscle Shoals	MSL	NA		Class I	A
	Tuscaloosa Muni	Tuscaloosa	TCL	NA		Class IV	A
Alaska	Adak	Adak Island	ADK	NA		Class I	A
	Kodiak	Kodiak	ADQ	Non		Class I	A
	Red Dog	Red Dog	AED	NA		Class IV	A
	King Salmon	King Salmon	AKN	Non		Class I	A
	Anchorage Int'l	Anchorage	ANC	Med		Class I	E
	Bethel	Bethel	BET	Non		Class I	A
	Wiley Post-Will Rogers Mem	Barrow	BRW	Non		Class I	B
	Cold Bay	Cold Bay	CDB	NA		Class I	B
	Merle K (Mudhole) Smith	Cordova	CDV	Non		Class I	B
	Dillingham	Dillingham	DLG	Non		Class I	A
	Unalaska	Unalaska	DUT	Non		Class I	A
	Kenai Muni	Kenai	ENA	Non		Class I	A
	Fairbanks Int'l	Fairbanks	FAI	Sm		Class I	C
	Galbraith Lake	Galbraith Lake	GBH	NA		Class IV	A
	Gustavus	Gustavus	GST	Non		Class I	A
	Homer	Homer	HOM	Non		Class I	A
	Juneau Int'l	Juneau	JNU	Sm		Class I	B
	Ketchikan Int'l	Ketchikan	KTN	Non		Class I	B
	Nome	Nome	OME	Non		Class I	B
	Ralph Wien Mem	Kotzebue	OTZ	Non		Class I	B
	Prospect Creek	Prospect Creek	PPC	NA		Class IV	A
	Petersburg James Johnson	Petersburg	PSG	Non		Class I	A
	Deadhorse	Deadhorse	SCC	Non		Class I	B
	Sitka Rocky Gutierrez	Sitka	SIT	NA		Class I	B
	Valdez	Valdez	VDZ	Non		Class I	A
	Wrangell	Wrangell	WRG	Non		Class I	A
	Yakutat	Yakutat	YAK	Non		Class I	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
American Samoa	Fitiuta	Fitiuta	FAQ	NA		Class III	A
	Pago Pago Int'l	Pago Pago	PPG	Non		Class I	C
	Ofu	Ofu	Z08	NA		Class III	A
Arizona	Grand Canyon West	Peach Springs	1G4	Non		Class III	A
	Fort Huachuca-Sierra Vista	Sierra Vista	FHU	NA	Inactive	Class III	A
	Flagstaff Pulliam	Flagstaff	FLG	Non		Class I	A
	Grand Canyon National Park	Grand Canyon	GCN	Sm		Class II	A
	Lake Havasu City	Lake Havasu City	HII	NA	Inactive	Class III	A
	Laughlin/Bullhead Int'l	Bullhead City	IFP	Non		Class I	A
	Kingman	Kingman	IGM	NA		Class II	A
	Phoenix-Mesa Gateway	Phoenix	IWA	NA		Class I	B
	Page Muni	Page	PGA	Non		Class II	A
	Phoenix Sky Harbor Int'l	Phoenix	PHX	Lg		Class I	D
	Ernest Love Fld	Prescott	PRC	NA		Class II	A
	Show Low Muni	Show Low	SOW	NA		Class III	A
	Tucson Int'l	Tucson	TUS	Med		Class I	C
	Yuma MCAS-Yuma Intl	Yuma	YUM	Non		Class I	A
Arkansas	South Arkansas Reg	El Dorado	ELD	NA		Class III	A
	Fort Smith Reg	Fort Smith	FSM	Non		Class I	A
	Drake Fld	Fayetteville	FYV	NA		Class IV	A
	Memorial Fld	Hot Springs	HOT	NA		Class II	A
	Boone Co	Harrison	HRO	NA		Class III	A
	Jonesboro Muni	Jonesboro	JBR	NA		Class III	A
	Adams Fld	Little Rock	LIT	Sm		Class I	C
	Texarkana Reg-B25Webb Fld	Texarkana	TXK	Non		Class I	A
	Northwest Arkansas	Fayetteville	XNA	Sm		Class I	B

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
California	Arcata	Arcata/Eureka	ACV	Non		Class I	A
	Meadows Fld	Bakersfield	BFL	Non		Class I	A
	Bob Hope	Burbank	BUR	Med		Class I	C
	Buchanan Fld	Concord	CCR	NA	Inactive	Class IV	A
	Jack McNamara Fld	Crescent City	CEC	Non		Class II	A
	Chico Muni	Chico	CIC	Non		Class III	A
	McClellan-Palomar	Carlsbad	CRQ	Non		Class I	A
	Fresno Yosemite Int'l	Fresno	FAT	Sm		Class I	B
	Imperial County	Imperial County	IPL	Non		Class III	A
	Inyokern	Inyokern	IYK	Non		Class III	A
	Los Angeles Int'l	Los Angeles	LAX	Lg		Class I	E
	Long Beach/Daugherty Fld	Long Beach	LGB	Sm		Class I	C
	Merced Muni	Merced	MCE	NA		Class II	B
	Castle	Merced/(Atwater)	MER	NA	Inactive	Class I	B
	Mammoth Yosemite	Mammoth Lakes	MMH	NA		Class I	B
	Modesto City/Harry Sham	Modesto	MOD	Non		Class II	B
	Monterey Peninsula	Monterey	MRY	Non		Class I	B
	Metro Oakland Int'l	Oakland	OAK	Med		Class I	D
	Ontario Int'l	Ontario	ONT	Med		Class I	D
	Oxnard	Oxnard	OXR	Non		Class III	A
	Palm Springs Reg	Palm Springs	PSP	Sm		Class I	C
	Redding Muni	Redding	RDD	Non		Class I	A
	San Diego Int'l	San Diego	SAN	Lg		Class I	D
	Santa Barbara Muni	Santa Barbara	SBA	Sm		Class I	C
	San Bernardino Int'l	San Bernardino	SBD	NA	Inactive	Class IV	B
	San Luis Obispo Co	San Luis Obispo	SBP	Non		Class I	A
	Stockton Metro	Stockton	SCK	Non		Class I	B
	San Francisco Int'l	San Francisco	SFO	Lg		Class I	E
	San Jose Int'l	San Jose	SJC	Med		Class I	D
	Sacramento Int'l	Sacramento	SMF	Med		Class I	C
	Santa Maria Pub	Santa Maria	SMX	Non		Class I	A
	John Wayne-Orange Co	Santa Ana	SNA	Med		Class I	C
	Charles M. Schulz-Sonoma Co	Santa Rosa	STS	NA		Class I	B
	Southern Calif. Logistics	Victorville	VCV	NA		Class IV	C
	Visalia Muni	Visalia	VIS	NA		Class II	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Colorado	Akron-Washington Co	Akron	AKO	NA		Class IV	A
	San Luis Valley Reg/Bergm	Alamosa	ALS	NA		Class II	A
	Aspen-Pitkin Co Sardy	Aspen	ASE	Non		Class I	B
	Rocky Mountain Metropolitan Airport	Denver	BJC	NA		Class II	A
	Cortez Muni	Cortez	CEZ	NA		Class III	A
	Colorado Springs Muni	Colorado Springs	COS	Sm		Class I	C
	Denver Int'l	Denver	DEN	Lg		Class I	E
	Durango-LaPlata Co	Durango	DRO	Non		Class I	B
	Eagle Co Reg	Eagle	EGE	Non		Class I	C
	Ft Collins/Loveland Muni	Fort Collins/Loveland	FNL	Non		Class I	B
	Walker Fld	Grand Junction	GJT	Non		Class I	B
	Gunnison Co	Gunnison	GUC	Non		Class I	B
	Yampa Valley	Hayden	HDN	Non		Class I	B
	Montrose Reg	Montrose	MTJ	Non		Class I	B
	Pueblo Muni	Pueblo	PUB	NA		Class II	B
	Telluride Reg	Telluride	TEX	Non		Class I	A
Connecticut	Bradley Int'l	Windsor Locks	BDL	Med		Class I	D
	Sikorsky Mem	Bridgeport	BDR	NA		Class IV	A
	Danbury Muni	Danbury	DXR	NA		Class IV	A
	Groton-New London	Groton/New London	GON	NA		Class IV	A
	Tweed-New Haven	New Haven	HVN	Non		Class I	A
Delaware	Dover Civil Air Terminal	Dover	DOV	NA		Class IV	A
	New Castle Co	Wilmington	ILG	NA		Class I	B
District of Columbia	Ronald Regan Washington National	Washington	DCA	Lg		Class I	C

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Florida	Naples Muni	Naples	APF	Non		Class I	A
	Daytona Beach Int'l	Daytona Beach	DAB	Non		Class I	C
	Key West Int'l	Key West	EYW	Non		Class I	A
	Fort Lauderdale/Hollywood Int'l	Fort Lauderdale	FLL	Lg		Class I	E
	Gainesville Reg	Gainesville	GNV	Non		Class I	A
	Jacksonville Int'l	Jacksonville	JAX	Med		Class I	D
	Lakeland Linder Reg	Lakeland	LAL	NA		Class IV	A
	Orlando Int'l	Orlando	MCO	Lg		Class I	D
	Miami Int'l	Miami	MIA	Lg		Class I	E
	Melbourne Reg	Melbourne	MLB	Non		Class I	C
	Marathon	Marathon	MTH	NA		Class I	A
	Ocala Muni	Ocala	OCF	NA		Class IV	A
	West Palm Beach Int'l	West Palm Beach	PBI	Med		Class I	D
	Panama City-Bay Co Int'l	Panama City	PFN	Non		Class I	B
	Charlotte Co	Punta Gorda	PGD	NA		Class I	A
	St. Petersburg/Clearwater Int'l	St. Petersburg/ Clearwater	PIE	Non		Class I	C
	Pensacola Reg	Pensacola	PNS	Sm		Class I	C
	SW Florida Int'l	Fort Myers	RSW	Med		Class I	D
	Orlando Sanford	Orlando	SFB	Sm		Class I	D
	St. Augustine	St. Augustine	SGJ	NA		Class I	A
	Sarasota/Bradenton Int'l	Sarasota/Bradenton	SRQ	Sm		Class I	C
	Space Center Executive	Titusville	TIX	NA		Class IV	A
	Tallahassee Reg	Tallahassee	TLH	Sm		Class I	C
	Tampa Int'l	Tampa	TPA	Lg		Class I	D
	Eglin Air Force Base	Valparaiso	VPS	Non		Class I	C
	Vero Beach Muni	Vero Beach	VRB	NA		Class IV	A
Georgia	SW Georgia Reg	Albany	ABY	Non		Class I	A
	Bush Fld	Augusta	AGS	Non		Class I	B
	Athens/Ben Epps	Athens	AHN	NA		Class II	A
	Hartsfield Atlanta Int'l	Atlanta	ATL	Lg		Class I	E
	Brunswick Golden Isles	Brunswick	BQK	Non		Class I	A
	Columbus Metro	Columbus	CSG	Non		Class I	B
	Middle Georgia Reg	Macon	MCN	Non		Class I	A
	Richard B Russell	Rome	RMG	NA		Class IV	A
	Savannah Int'l	Savannah	SAV	Sm		Class I	C
	Valdosta Reg	Valdosta	VLD	Non		Class I	A

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Guam	Guam Int'l	Agana	GUM	Sm		Class I	D
Hawaii	Honolulu Int'l	Honolulu	HNL	Lg		Class I	E
	Hilo Int'l	Hilo	ITO	Sm		Class I	C
	Kapalua	Lahaina	JHM	NA		Class I	A
	Kona Int'l at Keahole	Kailua/Kona	KOA	Sm		Class I	D
	Lihue	Lihue	LIH	Sm		Class I	C
	Lanai	Lanai City	LNY	Non		Class I	B
	Molokai	Kaunakakai	MKK	Non		Class I	B
	Kahului	Kahului	OGG	Med		Class I	D
Idaho	Boise Air Term	Boise	BOI	Sm		Class I	B
	Coeur D'Alene	Coeur D'Alene	COE	NA		Class IV	A
	Fanning Fld	Idaho Falls	IDA	Non		Class I	B
	Lewiston-Nez Perce Co	Lewiston	LWS	Non		Class I	A
	Pocatello Reg	Pocatello	PIH	Non		Class II	A
	Friedman Mem	Hailey (Sun Valley)	SUN	Non		Class I	A
	Magic Valley Reg	Twin Falls	TWF	Non		Class II	B
Illinois	St. Louis Reg	Alton/St Louis	ALN	NA	Inactive	Class IV	A
	Scott AFB/Midamerica	Belleville	BLV	Non		Class I	B
	Central Illinois Reg	Bloomington/Normal	BMI	Non		Class I	B
	University of Illinois	Champaign/Urbana	CMI	Non		Class I	B
	St. Louis Downtown	Cahokia	CPS	NA		Class IV	A
	Decatur	Decatur	DEC	Non		Class II	A
	Southern Illinois	Carbondale/ Murphysboro	MDH	NA		Class IV	A
	Chicago Midway	Chicago	MDW	Lg		Class I	D
	Quad City Int'l	Moline	MLI	Sm		Class I	B
	Coles Co Mem	Mattoon/Charleston	MTO	NA		Class IV	A
	Mount Vernon	Mount Vernon	MVN	NA	Inactive	Class IV	A
	Williamson Co Reg	Marion	MWA	Non		Class II	A
	Chicago O'Hare Int'l	Chicago	ORD	Lg		Class I	E
	Greater Peoria Reg	Peoria	PIA	Non		Class I	B
	Greater Rockford	Rockford	RFD	Non		Class I	A
	Abraham Lincoln Mem	Springfield	SPI	Non		Class I	A
	Quincy Reg	Quincy	UIN	NA		Class II	A

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Indiana	Columbus Muni	Columbus	BAK	NA	Inactive	Class IV	A
	Monroe Co	Bloomington	BMG	NA		Class IV	A
	Elkhart Muni	Elkhart	EKM	NA	Inactive	Class IV	A
	Evansville Reg	Evansville	EVV	Non		Class I	B
	Fort Wayne Int'l	Fort Wayne	FWA	Non		Class I	B
	Gary/Chicago	Gary	GYY	NA		Class I	B
	Terr Haute Int'l-Hulman Fld	Terre Haute	HUF	NA		Class IV	A
	Indianapolis Int'l	Indianapolis	IND	Med		Class I	D
	Purdue University	Lafayette	LAF	NA		Class IV	A
	Delaware Co	Muncie	MIE	NA		Class IV	A
	South Bend Reg	South Bend	SBN	Sm		Class I	B
	Porter Co Muni	Valparaiso	VPZ	NA	Inactive	Class IV	A
Iowa	Waterloo Regional	Waterloo	ALO	Non		Class I	A
	SE Iowa Reg	Burlington	BRL	NA		Class II	A
	The Eastern Iowa Airport	Cedar Rapids	CID	Sm		Class I	B
	Dubuque Reg	Dubuque	DBQ	Non		Class I	A
	Des Moines Int'l	Des Moines	DSM	Sm		Class I	C
	Ft. Dodge Reg	Ft. Dodge	FOD	NA		Class I	A
	Mason City Muni	Mason City	MCW	Non		Class I	A
	Sioux Gateway	Sioux City	SUX	Non		Class I	B
Kansas	Dodge City Reg	Dodge City	DDC	NA		Class III	
	Forbes Fld	Topeka	FOE	Non		Class IV	A
	Great Bend Muni	Great Bend	GBD	NA		Class III	
	Garden City Reg	Garden City	GCK	Non		Class II	A
	Hutchinson Muni	Hutchinson	HUT	NA		Class IV	A
	Hays Regional	Hays	HYS	Non		Class II	A
	Wichita Mid-Continent	Wichita	ICT	Sm		Class I	C
	Liberal Muni	Liberal	LBL	NA		Class II	A
	Manhattan Reg	Manhattan	MHK	Non		Class II	A
	Salina Muni	Salina	SLN	NA		Class II	A
Kentucky	Bowling Green/Warren Co Reg	Bowling Green	BWG	NA		Class IV	A
	Cincinnati/North Kentucky Int'l	Covington/Cincinnati	CVG	Lg		Class I	D
	Blue Grass	Lexington	LEX	Sm		Class I	B
	Owensboro-Davies Co	Owensboro	OWB	NA		Class II	A
	Barkley Reg	Paducah	PAH	Non		Class I	A
	Standiford Field	Louisville	SDF	Sm		Class I	C
	Lake Cumberland Reg	Somerset	SME	NA		Class II	A

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Louisiana	Alexandria Int'l	Alexandria	AEX	Non		Class I	D
	Acadiana Reg	New Iberia	ARA	NA		Class II	A
	Baton Rouge Metro-Ryan	Baton Rouge	BTR	Sm		Class I	C
	Chennault Int'l	Lake Charles	CWF	NA		Class IV	A
	Lake Charles Reg	Lake Charles	LCH	Non		Class I	A
	Lafayette Reg	Lafayette	LFT	Non		Class I	B
	Monroe Reg	Monroe	MLU	Non		Class I	B
	New Orleans Int'l	New Orleans	MSY	Med		Class I	D
	Shreveport Reg	Shreveport	SHV	Non		Class I	B
Maine	Augusta State	Augusta	AUG	NA		Class I	
	Bangor Int'l	Bangor	BGR	Sm		Class I	E
	Hancock Co-Bar Harbor	Bar Harbor	BHB	Non		Class I	
	No. Maine Reg	Presque Isle	PQI	Non		Class I	A
	Portland Int'l Jetport	Portland	PWM	Sm		Class I	C
	Knox Co Reg	Rockland	RKD	Non		Class III	
Northern Mariana Islands	Rota Island	Rota Island	GRO	Non		Class I	A
	Saipan Int'l	Saipan Island	GSN	Sm		Class I	D
	West Tinian	Tinian Island	TNI	Non		Class I	A
Maryland	Baltimore-Washington Int'l	Baltimore	BWI	Lg		Class I	D
	Hagerstown Reg	Hagerstown	HGR	NA		Class II	A
	Salisbury-Ocean City Wicomico Reg	Salisbury	SBY	Non		Class I	A
Massachusetts	Nantucket Mem	Nantucket	ACK	Non		Class I	A
	Barnes Muni	Westfield	BAF	NA		Class IV	A
	Laurence Hanscom Fld	Bedford	BED	Non		Class I	A
	Logan Int'l	Boston	BOS	Lg		Class I	E
	Westover AFB/Metro	Springfield/Chicopee	CEF	NA		Class I	E
	Barnstable Muni	Hyannis	HYA	Non		Class I	A
	Martha's Vineyard	Vineyard Haven	MVY	Non		Class I	A
	Worcester Reg	Worcester	ORH	Non		Class I	A

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Michigan	Alpena Co Reg	Alpena	APN	NA		Class I	A
	W K Kellogg	Battle Creek	BTL	NA		Class IV	A
	Chippewa Co Int'l	Sault Ste Marie	CIU	Non		Class I	A
	Ford	Iron Mountain/Kingsford	IMT	NA		Class II	A
	Gogebic-Iron Co	Ironwood	IWD	NA		Class II	A
	Manistee Co-Blacker	Manistee	MBL	NA		Class III	A
	Oakland Co Int'l	Pontiac	PTK	NA		Class IV	A
	Willow Run	Detroit	YIP	NA		Class IV	A
	Kalamazoo/Btl Crk Int'l	Kalamazoo	AZO	Non		Class I	B
	Houghton Co Mem	Hancock	CMX	Non		Class I	A
	Detroit Metro Wayne Co	Detroit	DTW	Lg		Class I	E
	Delta Co	Escanaba	ESC	Non		Class II	A
	Bishop Int'l	Flint	FNT	Sm		Class I	B
	Gerald R. Ford International	Grand Rapids	GRR	Sm		Class I	C
	Capital City	Lansing	LAN	Non		Class I	B
	MBS Int'l	Saginaw	MBS	Non		Class I	B
	Muskegon Co	Muskegon	MKG	Non		Class I	A
	Pellston Reg Arpt of Emmet	Pellston	PLN	Non		Class I	A
	Marquette Co	Marquette	SAW	Non		Class I	A
	Cherry Capital	Traverse City	TVC	Non		Class I	B
Midway Island	Henderson Fld	Sand Island	MDY	NA		Class IV	A
Minnesota	Bemidji-Beltrami Co	Bemidji	BJI	Non		Class I	A
	Brainerd-Crow Wing Reg	Brainerd	BRD	Non		Class I	A
	Duluth Int'l	Duluth	DLH	Non		Class I	B
	Chisholm-Hibbing	Hibbing	HIB	Non		Class I	A
	Falls Int'l	International Falls	INL	Non		Class I	A
	Minneapolis-St Paul Int'l	Minneapolis	MSP	Lg		Class I	E
	Rochester Int'l	Rochester	RST	Non		Class I	B
	Thief River Falls Reg	Thief River Falls	TVF	NA		Class I	A
	St Cloud Reg	St Cloud	STC	Non		Class I	A

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Mississippi	Greenville Regl	Greenville	GLH	NA		Class I	A
	Gulfport-Biloxi Reg	Gulfport	GPT	Sm		Class I	B
	Golden Triangle Reg	Columbus/W Point	GTR	Non		Class I	A
	Natches-Adams County	Natchez	HEZ	NA		Class IV	A
	Stennis Int'l	Bay St Louis	HSA	NA		Class IV	A
	Jackson Int'l	Jackson	JAN	Sm		Class I	C
	Key Fld	Meridian	MEI	Non		Class I	A
	Hattiesburg-Laurel Reg	Hattiesburg/Laurel	PIB	Non		Class I	A
	Tupelo Muni	Tupelo	TUP	Non		Class I	A
	University-Oxford	Oxford	UOX	NA		Class IV	A
	Tunica	Tunica	UTA	Non		Class I	B
Missouri	Cape Girardeau Reg	Cape Girardeau	CGI	NA		Class III	A
	Columbia Reg	Columbia	COU	Non		Class I	A
	Kirksville Reg	Kirksville	IRK	NA		Class III	
	Joplin Reg	Joplin	JLN	Non		Class II	A
	Kansas City Int'l	Kansas City	MCI	Med		Class I	C
	Charles B Wheeler Downtown	Kansas City	MKC	NA		Class IV	A
	Springfield-Branson National	Springfield	SGF	Sm		Class I	B
	Rosecrans Mem	St Joseph	STJ	NA		Class IV	A
	Lambert-St Louis Int'l	St Louis	STL	Med		Class I	D
	Spirit of St Louis	St Louis	SUS	NA		Class IV	A
Montana	Billings Logan Int'l	Billings	BIL	Sm		Class I	C
	Bert Mooney	Butte	BTM	Non		Class I	A
	Gallatin Fld	Bozeman	BZN	Non		Class I	B
	Glacier Park Int'l	Kalispell	GPI	Non		Class I	B
	Dawson ComMuni	Glendive	GDV	NA		Class III	
	Wokal Fld/Glasgow Int'l	Glasgow	GGW	NA		Class III	
	Great Falls Int'l	Great Falls	GTF	Non		Class I	C
	Helena Reg	Helena	HLN	Non		Class I	B
	Havre City-Co	Havre	HVR	NA		Class III	
	Lewistown Muni	Lewistown	LWT	NA		Class III	
	Frank Wiley Fld.	Miles City	MLS	NA		Class III	
	Missoula Int'l	Missoula	MSO	Non		Class I	B
	LM Clayton	Wolf Point	OLF	NA		Class III	
	Sidney-Richland Muni	Sidney	SDY	NA		Class III	
	Yellowstone	West Yellowstone	WYS	NA		Class II	A

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Nebraska	Alliance Muni	Alliance	AIA	NA		Class III	
	Western Nebraska Reg	Scottsbluff	BFF	Non		Class II	A
	Chadron Muni	Chadron	CDR	NA		Class III	
	Kearney Regional	Kearney	EAR	NA		Class III	
	Central Nebraska Reg	Grand Island	GRI	NA		Class I	B
	North Platte Reg	North Platte	LBF	NA		Class II	A
	Lincoln Muni	Lincoln	LNK	Non		Class I	B
	McCook Muni	McCook	MCK	NA		Class III	
	Eppley Airfield	Omaha	OMA	Med		Class I	C
Nevada	Elko Muni	Elko	EKO	Non		Class I	A
	Yelland Fld	Ely	ELY	NA		Class II	A
	McCarran Int'l	Las Vegas	LAS	Lg		Class I	D
	Reno/Tahoe Int'l	Reno	RNO	Med		Class I	C
	North Las Vegas	Las Vegas	VGT	Non	Inactive	Class III	A
New Hampshire	Lebanon Muni	Lebanon	LEB	Non		Class I	A
	Manchester	Manchester	MHT	Med		Class I	C
	Pease Int'l Tradeport	Portsmouth	PSM	Non		Class I	B
New Jersey	Atlantic City Int'l	Atlantic City	ACY	Sm		Class I	C
	Newark Liberty Int'l	Newark	EWR	Lg		Class I	E
	Teterboro	Teterboro	TEB	Non		Class IV	A
	Trenton Mercer	Trenton	TTN	Non		Class I	B
New Mexico	Albuquerque Int'l Sunport	Albuquerque	ABQ	Med		Class I	C
	Alamogordo-White Sands	Alamogordo	ALM	NA		Class III	A
	Cavern City Air Term	Carlsbad	CNM	NA		Class II	A
	Clovis Municipal	Clovis	CVN	NA		Class III	A
	Four Corners Reg	Farmington	FMN	Non		Class III	A
	Las Cruces Int'l	Las Cruces	LRU	NA		Class IV	A
	Roswell Int'l Air Ctr	Roswell	ROW	NA		Class I	A
	Santa Fe Muni	Santa Fe	SAF	NA		Class I	A
	Sierra Blanca Reg	Ruidoso	SRR	NA		Class IV	A
	Grant Co	Silver City	SVC	NA		Class III	A

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New York	Albany Co	Albany	ALB	Sm		Class I	C
	Watertown Int'l	Watertown	ART	NA		Class II	A
	Greater Binghamton/E A Link Fld	Binghamton	BGM	Non		Class I	B
	Buffalo Niagara Int'l	Buffalo	BUF	Med		Class I	D
	Elmira/Corning Reg	Elmira	ELM	Non		Class I	B
	Republic	Farmingdale	FRG	NA		Class IV	A
	Floyd Bennett Mem	Glens Falls	GFL	NA		Class IV	A
	Westchester Co	White Plains	HPN	Sm		Class I	B
	Niagara Falls Int'l	Niagara Falls	IAG	NA		Class I	B
	Long Island MacArthur	Islip	ISP	Sm		Class I	B
	Ithaca Tompkins Reg	Ithaca	ITH	Non		Class I	B
	JFK Int'l	New York	JFK	Lg		Class I	E
	Chautauqua Co/Jamestown	Jamestown	JHW	NA		Class I	A
	La Guardia	New York	LGA	Lg		Class I	D
	Massena Int'l - Richards Fld	Massena	MSS	NA		Class II	A
	Sullivan Co Int'l	Monticello	MSV	NA		Class IV	A
	Ogdensburg Int'l	Ogdensburg	OGS	NA		Class II	A
	Plattsburgh Int'l	Plattsburgh	PBG	NA		Class I	A
	Dutchess Co	Poughkeepsie	POU	NA		Class IV	A
	Griffiss Airpark	Rome	RME	NA		Class IV	A
	Greater Rochester Int'l	Rochester	ROC	Sm		Class I	C
	Adirondack Reg	Saranac Lake	SLK	NA		Class II	A
	Stewart Int'l	Newburgh	SWF	Non		Class I	C
	Syracuse Hancock Int'l	Syracuse	SYR	Sm		Class I	C
North Carolina	Ashville Int'l	Asheville	AVL	Non		Class I	B
	Charlotte/Douglas Int'l	Charlotte	CLT	Lg		Class I	D
	Concord Regional	Concord	JQF	NA		Class IV	A
	Craven Co Reg	New Bern	EWN	Non		Class I	A
	Fayetteville Reg/Grannis Fl	Fayetteville	FAY	Non		Class I	C
	Piedmont-Greensboro	Greensboro	GSO	Sm		Class I	C
	Hickory Municipal	Hickory	HKY	NA		Class I	A
	Wilmington Int'l	Wilmington	ILM	Non		Class I	B
	Smith Reynolds	Winston-Salem	INT	NA		Class I	A
	Kinston Reg Jetport	Kinston	ISO	Non		Class I	A
	Albert J Ellis	Jacksonville	OAJ	Non		Class I	A
	Pitt-Greenville	Greenville	PGV	Non		Class I	A
	Raleigh-Durham Int'l	Raleigh/Durham	RDU	Med		Class I	D
	Rocky Mount-Wilson	Rocky Mount	RWI	NA		Class IV	A
	Moore Co	Southern Pines	SOP	NA		Class IV	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
North Dakota	Bismark Muni	Bismark	BIS	Non		Class I	B
	Dickinson Muni	Dickinson	DIK	NA		Class III	A
	Devils Lake Muni	Devils Lake	DVL	NA		Class I	A
	Hector Int'l	Fargo	FAR	Non		Class I	C
	Grand Forks Int'l	Grand Forks	GFK	Non		Class I	B
	Sloulin Fld. Int'l	Williston	ISN	NA		Class II	A
	Jamestown Muni	Jamestown	JMS	NA		Class I	A
	Minot Int'l	Minot	MOT	Non		Class I	B
Ohio	Burke Lakefront	Cleveland	BKL	NA		Class IV	A
	Akron-Canton Reg	Akron	CAK	Sm		Class I	B
	Cleveland-Hopkins Int'l	Cleveland	CLE	Med		Class I	C
	Port Columbus Int'l	Columbus	CMH	Med		Class I	C
	Cox Dayton Int'l	Dayton	DAY	Sm		Class I	C
	Airborne Airpark	Wilmington	ILN	NA	Inactive	Class IV	A
	Rickenbacker Int'l	Columbus	LCK	NA		Class I	A
	Cincinnati Muni	Cincinnati	LUK	NA		Class IV	A
	Mansfield Lahm Muni	Mansfield	MFD	NA		Class IV	A
	Ohio State University	Columbus	OSU	NA	Inactive	Class IV	A
	Springfield-Beckley Muni	Springfield	SGH	NA	Inactive	Class IV	A
	Toledo Express	Toledo	TOL	Non		Class I	B
	Youngstown-Warren Reg	Youngstown/ Warren	YNG	Non		Class I	B
Oklahoma	Lawton-Ft Still Reg	Lawton	LAW	Non		Class I	A
	Will Rogers World	Oklahoma City	OKC	Sm		Class I	C
	Stillwater Muni	Stillwater	SWO	NA		Class IV	A
	Tulsa Int'l	Tulsa	TUL	Sm		Class I	D
Oregon	Astoria Reg	Astoria	AST	NA		Class IV	A
	Mahlon Sweet Fld	Eugene	EUG	Non		Class I	B
	Klamath Falls Int'l	Klamath Falls	LMT	Non		Class I	A
	Rogue Valley Int'l	Medford	MFR	Non		Class I	B
	Newport Muni	Newport	ONP	NA		Class IV	A
	North Bend Muni	North Bend	OTH	Non		Class I	A
	Eastern Oregon Reg	Pendleton	PDT	NA		Class I	A
	Portland Int'l	Portland	PDX	Med		Class I	E
	Roberts Fld	Redmond	RDM	Non		Class I	B
	McNary Fld	Salem	SLE	NA		Class IV	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Pennsylvania	Lehigh Valley Int'l	Allentown	ABE	Sm		Class I	C
	Altoona-Blair Co	Altoona	AOO	NA		Class I	A
	Wilkes-Barre/Scranton Int'l	Wilkes-Barre/Scranton	AVP	Non		Class I	B
	Bradford Reg	Bradford	BFD	NA		Class I	A
	Du Bois-Jefferson Co	Du Bois	DUJ	NA		Class II	A
	Erie Int'l/Tom Ridge Fld	Erie	ERI	Non		Class I	B
	Venango Reg	Franklin	FKL	NA		Class II	A
	Williamsport Reg	Williamsport	IPT	Non		Class I	A
	John Murtha Johnstown-Cambria Co	Johnstown	JST	Non		Class I	A
	Arnold Palmer Reg	Latrobe	LBE	Non		Class I	A
	Lancaster	Lancaster	LNS	NA		Class II	A
	Harrisburg Int'l	Harrisburg	MDT	Sm		Class I	C
	Philadelphia Int'l	Philadelphia	PHL	Lg		Class I	E
	Pittsburgh Int'l	Pittsburgh	PIT	Med		Class I	D
	Reading Reg/C A Spatz Fld	Reading	RDG	NA		Class IV	A
	University Park	State College	UNV	Non		Class I	B
Puerto Rico	Rafael Hernandez	Aguadilla	BQN	Non		Class I	B
	Mercedita	Ponce	PSE	Non		Class I	C
	Luis Munoz Marin Int'l	San Juan	SJU	Med		Class I	D
	Antonio Rivera Rodriguez	Isla de Vieques	VQS	Non		Class I	A
Rhode Island	Theodore Francis Green State	Providence	PVD	Med		Class I	C
South Carolina	Donaldson Ctr	Greenville	GYH	NA		Class IV	A
	Anderson Co	Anderson	AND	NA		Class IV	A
	Columbia Metro	Columbia	CAE	Sm		Class I	C
	Charleston International	Charleston	CHS	Sm		Class I	C
	Florence Reg	Florence	FLO	Non		Class I	A
	Greenville-Spartanburg	Greer	GSP	Sm		Class I	C
	Hilton Head	Hilton Head Island	HXD	Non		Class I	A
	Myrtle Beach Jetport	Myrtle Beach	MYR	Sm		Class I	C
South Dakota	Aberdeen Reg	Aberdeen	ABR	Non		Class I	A
	Watertown Muni	Watertown	ATY	NA		Class I	A
	Brookings Muni	Brookings	BKX	NA		Class II	A
	Joe Foss Fld	Sioux Falls	FSD	Sm		Class I	B
	Huron Reg	Huron	HON	NA		Class II	A
	Pierre Reg	Pierre	PIR	Non		Class I	A
	Rapid City Reg	Rapid City	RAP	Non		Class I	B

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Tennessee	Nashville Int'l	Nashville	BNA	Med		Class I	C
	Lovell Fld	Chattanooga	CHA	Non		Class I	B
	Memphis Int'l	Memphis	MEM	Med		Class I	C
	McKellar-Sipes Reg	Jackson	MKL	NA		Class I	A
	Smyrna	Smyrna	MQY	NA		Class IV	A
	Millington Muni	Millington	NQA	NA		Class IV	A
	Tri-City Municipal	Bristol/Johnson/Kingsport	TRI	Non		Class I	B
	McGhee Tyson	Knoxville	TYS	Sm		Class I	C
Texas	Abilene Reg	Abilene	ABI	Non		Class I	A
	Waco Reg	Waco	ACT	Non		Class I	A
	Fort Worth Alliance	Fort Worth	AFW	NA		Class IV	A
	Amarillo Int'l	Amarillo	AMA	Sm		Class I	B
	Austin Bergstrom Intl	Austin	AUS	Med		Class I	D
	Jefferson Co	Beaumont/Port Arthur	BPT	Non		Class I	A
	Brownsville/South Padre Island	Brownsville	BRO	Non		Class I	B
	Easterwood Fld	College Station	CLL	Non		Class I	A
	Corpus Christi Int'l	Corpus Christi	CRP	Sm		Class I	C
	Dallas Love Fld	Dallas	DAL	Med		Class I	C
	Dallas/Ft Worth Int'l	Dallas-Fort Worth	DFW	Lg		Class I	E
	Del Rio Int'l	Del Rio	DRT	Non		Class I	A
	Ellington Fld	Houston	EFD	NA		Class IV	A
	El Paso Int'l	El Paso	ELP	Sm		Class I	C
	Fort Worth Meacham Int'l	Fort Worth	FTW	NA		Class IV	A
	Gregg Co	Longview	GGG	Non		Class I	A
	Killeen/Ft. Hood Reg	Killeen	GRK	Non		Class I	E
	William Hobby	Houston	HOU	Med		Class I	C
	Valley Int'l	Harlingen	HRL	Sm		Class I	B
	Bush Intercontinental	Houston	IAH	Lg		Class I	E
	Lubbock Int'l	Lubbock	LBB	Sm		Class I	C
	Brazoria County Airport	Angleton	LBX	NA		Class IV	A
	Laredo Int'l	Laredo	LRD	Non		Class I	B
	Midland Int'l	Midland	MAF	Sm		Class I	C
	Mc Allen Miller Int'l	Mc Allen	MFE	Sm		Class I	C
	San Antonio Int'l	San Antonio	SAT	Med		Class I	C
	Mathis Fld	San Angelo	SJT	Non		Class I	B
	Shepard AFB/Wichita Falls	Wichita Falls	SPS	Non		Class I	A
	Draughon-Miller Central Texas	Temple	TPL	NA		Class IV	A
	Tyler Pounds Fld	Tyler	TYR	Non		Class I	A
	Victoria Reg	Victoria	VCT	NA		Class I	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Utah	Cedar City Muni	Cedar City	CDC	NA		Class II	A
	Canyonlands Field	Moab	CNY	NA		Class III	
	Wendover	Wendover	ENV	Non		Class I	B
	Ogden-Hinckley	Ogden	OGD	NA		Class IV	A
	Provo Muni	Provo	PVU	NA		Class IV	A
	St George Muni	St George	SGU	Non		Class III	A
	Salt Lake City Int'l	Salt Lake City	SLC	Lg		Class I	E
	Vernal Airport	Vernal	VEL	NA		Class III	
Vermont	Burlington Int'l	Burlington	BTV	Sm		Class I	B
	Rutland State	Rutland	RUT	NA		Class IV	
Virgin Islands	Cyril E King	Charlotte Amalie	STT	Sm		Class I	C
	Henry E Rohlsen	Christiansted	STX	Non		Class I	C
Virginia	Charlottesville-Albemarle	Charlottesville	CHO	Non		Class I	B
	Lynchburg Reg/ Preston Glenn Fld	Lynchburg	LYH	Non		Class I	A
	Norfolk Int'l	Norfolk	ORF	Med		Class I	C
	Newport News/Williamsburg Int'l	Newport News	PHF	Sm		Class I	B
	Richmond Int'l	Richmond	RIC	Sm		Class I	C
	Roanoke Reg/Woodrum Fld	Roanoke	ROA	Non		Class I	B
	Shenandoah Valley Reg	Staunton Waynesboro	SHD	NA		Class I	B
	Washington Dulles Int'l	Washington, DC	IAD	Lg		Class I	E
Washington	Walla Walla Reg	Walla Walla	ALW	Non		Class I	A
	Boeing Fld	Seattle	BFI	Non		Class II	A
	Bellingham Int'l	Bellingham	BLI	Non		Class I	B
	Pangborn Mem	Wenatchee	EAT	Non		Class I	A
	Spokane Int'l	Spokane	GEG	Sm		Class I	C
	Grant Co	Moses Lake	MWH	NA		Class II	A
	Olympia	Olympia	OLM	NA		Class IV	A
	Snohomish Co	Everett	PAE	NA		Class IV	A
	Tri-Cities	Pasco	PSC	Non		Class I	B
	Pullman/Moscow Reg	Pullman/Moscow	PUW	Non		Class I	A
	Seattle-Tacoma Int'l	Seattle	SEA	Lg		Class I	E
	Yakima Air Term	Yakima	YKM	Non		Class I	A
West Virginia	Raleigh Co Mem	Beckley	BKW	NA		Class II	A
	Mercer Co	Bluefield	BLF	NA		Class III	A
	Harrison/Marion Reg	Clarksburg	CKB	NA		Class I	A
	Yeager	Charleston	CRW	Non		Class I	B
	Tri-State/Milton J Ferguson Fld	Huntington	HTS	Non		Class I	B
	Greenbrier Valley	Lewisburg	LWB	Non		Class I	B
	Morgantown Muni	Morgantown	MGW	NA		Class I	A
	Mid-Ohio Valley Reg	Parkersburg	PKB	NA		Class I	A

State	Airport Name	Associated City	Airport LocID	Hub Type	Inactive Status	New Part 139 Classification	ARFF Index
Wisconsin	Outagamie Co	Appleton	ATW	Non		Class I	B
	Central Wisconsin	Mosinee	CWA	Non		Class I	A
	Chippewa Valley Reg	Eau Claire	EAU	Non		Class I	A
	Austin Straubel Int'l	Green Bay	GRB	Sm		Class I	C
	Rock Co	Janesville	JVL	NA	Inactive	Class IV	A
	La Crosse Muni	La Crosse	LSE	Non		Class I	B
	General Mitchell Int'l	Milwaukee	MKE	Med		Class I	C
	Dane Co Reg	Madison	MSN	Sm		Class I	C
	Rhinelander-Oneida Co	Rhinelander	RHI	Non		Class I	A
Wyoming	Yellowstone Reg	Cody	COD	Non		Class I	A
	Natrona Co Int'l	Casper	CPR	Non		Class I	A
	Cheyenne	Cheyenne	CYS	Non		Class II	A
	Gillette-Campbell Co	Gillette	GCC	Non		Class II	A
	Jackson Hole	Jackson	JAC	Non		Class I	B
	Laramie Reg	Laramie	LAR	Non		Class II	A
	Riverton Reg	Riverton	RIW	Non		Class II	A
	Rock Springs-Sweetwater	Rock Springs	RKS	Non		Class II	A
	Sheridan Co	Sheridan	SHR	Non		Class II	A
	Worland Muni	Worland	WRL	Non		Class III	A

Inactive	15	Index A	290
		Index B	116
Class I	377	Index C	80
Class II	57	Index D	32
Class III	42	Index E	24
Class IV	86	Index not listed	20
TOTAL Part 139 Airports	562		562

APPENDIX B
AIRCRAFT LENGTH AND WIDTH

Aircraft	Length	Width	Index based on FAA	Index based on ICAO & NFPA
Airbus 318	103 ft 2 in	13 ft	B	B
Airbus 319	111 ft 0 in	13 ft	B	B
Airbus 320	123 ft 3 in	13 ft	B	B
Airbus 300-600	177 ft 5 in	18 ft 6 in	D	D
Airbus 310	*153 ft 1 in*	*18 ft 6 in*	*C*	***D***
Airbus 330-200	193 ft 0 in	18 ft 6 in	D	D
Airbus 330-300	208 ft 10 in	18 ft 6 in	E	E
Airbus 340-200	194 ft 10 in	18 ft 6 in	D	D
Airbus 340-300	208 ft 10 in	18 ft 6 in	E	E
Airbus 340-500	222 ft 8 in	18 ft 6 in	E	E
Airbus 340-600	246 ft 11 in	18 ft 6 in	E	E
Airbus 380	239 ft 3 in	23 ft 5 in	E	*
ATR 42 (48 pax)	74 ft 5 in	Aprox 10 ft	A	A
ATR 72 (70 pax)	89 ft 2 in	Aprox 10 ft	A	A
Bombardier CRJ 200 (50 pax)	87 ft 10 in	8 ft 10 in	A	A
CRJ 700 (70 pax)	106 ft 5 in	8 ft 10 in	B	B
CRJ 705 (75 pax)	119 ft 4 in	8 ft 10 in	B	B
CRJ 900 (90 pax)	119 ft 4 in	8 ft 10 in	B	B
CRJ 1000 (100 pax)	128 ft 5in	8 ft 10 in	C	C
C 110 (110 pax)	115 ft 3 in	10 ft 0 in	B	B
C 130 (130 pax)	125 ft 9 in	10 ft 0 in	B	B
Boeing 717	124 ft	10 ft 4 in	B	B
Boeing 737-300	109 ft 7 in	11 ft 7 in	B	B
Boeing 737-400	119 ft 7 in	11 ft 7 in	B	B
Boeing 737-600	102 ft 6 in	11 ft 7 in	B	B
Boeing 737-700	110 ft 4 in	11 ft 7 in	B	B
Boeing 737-800	129 ft 6 in	11 ft 7 in	C	C
Boeing 737-900	138 ft 3 in	11 ft 7 in	C	C
Boeing 747-100	231 ft 10 in	20 ft	E	E
Boeing 747-200	231 ft 10 in	20 ft	E	E
Boeing 747-300	231 ft 10 in	20 ft	E	E
Boeing 747-400	231 ft 10 in	20 ft	E	E
Boeing 747-400ER	231 ft 10 in	20 ft	E	E
Boeing 747-8	250 ft 8 in	20 ft	E	E
Boeing 757-200	155 ft 3 in	12 ft 3 in	C	C
Boeing 767-200	159 ft 2 in	15 ft 6 in	D	D
Boeing 767-300	180 ft 3 in	15 ft 6 in	D	D
Boeing 767-400ER	201 ft 4 in	15 ft 6 in	E	E
Boeing 777-200	209 ft 1 in	19 ft	E	E
Boeing 777-300	242 ft 4 in	19 ft	E	E
Boeing 777-200LR	209 ft 1 in	19 ft	E	E
Boeing 777-300ER	242 ft 4 in	19 ft	E	E
Boeing 787-3	186 ft		D	**
Boeing 787-8	186 ft		D	**
Boeing 787-9	206 ft		E	**

Aircraft	Length	Width	Index based on FAA	Index based on ICAO & NFPA
DeHavilland Dash8 400 (75 pax)	107 ft 9 in	8 ft 10 in	B	B
Embraer 135	86 ft 5 in	7 ft 6 in	A	A
Embraer 140	93 ft 4 in	7 ft 6 in	B	B
Embraer 145	98 ft 0 in	7 ft 6in	B	B
Embraer 170	98 ft 1 in	11 ft 0 in	B	B
Embraer 175	103 ft 11 in	11 ft 0 in	B	B
Embraer 190	118 ft 11 in	11 ft 0 in	B	B
Embraer 195	126 ft 10 in	11 ft 0 in	C	C

*A-380 - While the length of the A-380 would keep the aircraft designated as an Index E, the width could require an increased Index, were FAA to adopt an Index higher than E and use width to determine such Index.

** Boeing 787-3, -8, -9; No widths available at the time this table was put together.

APPENDIX C
INTERVIEW GUIDE RESPONSE FORM

This research is being conducted as part of a study by the Transportation Research Board's Airport Cooperative Research Program. The study is "How Proposed ARFF Standards Would Impact Airports."[1]

> 14 CFR Part 139 requires certain airports to meet specific aircraft rescue and fire fighting (ARFF) standards. It has been suggested that Part 139 be revised to require airports to comply with certain National Fire Protection Association (NFPA) standards and/or of International Civil Aviation Organization (ICAO) fire fighting standards set forth in Annex 14. The purpose of the study is to: a) compare the current FAA requirements for ARFF to the proposed NFPA and ICAO standards, b) provide a financial analysis of the capital and operating costs for airports to comply with the NFPA and ICAO standards, to the extent that they differ from the costs currently incurred to comply with FAA requirements, and c) if there are increased costs associated with NFPA or ICAO standards, examine the possible impact that such costs will have on the cost per enplaned passenger at an airport.

Thank you for agreeing to participate in this research by being interviewed on ARFF at your airport. This document is an interview guide, intended to let you know what questions will be asked by the interviewer and give you an opportunity to have your responses prepared. Please read through it as soon as possible. If you're uncertain about the meaning of a question, or for issues related to scheduling of the interview, contact Benedict Castellano or Robert E. David, who will be conducting the interviews. If you want to know more about the study itself, contact Marci Greenberger with ACRP.

Points of Contact:

Airport Cooperative Research Program Marci Greenberger 202-334-1371 mgreenberger@nas.edu	Benedict Castellano 410-672-2322 ben.castellano@airportsafetyconsultants.com
GRA, Incorporated Greg Helledy 215-884-7500 gregsonh@gra-inc.com	Robert E. David 540-273-4167 bdavid@robertedavid.com

[1] The study is referenced on the TRB webpage at this address as Task 11: http://www.trb.org/TRBNet/ProjectDisplay.asp?ProjectID=127

A. Interviewee Information

Airport LocID			
Name			
Title			
Organization			
Email address			
Telephone			

B. General

1	The airport is owned by: a. A municipality or county b. An authority c. A state agency (excluding authorities) d. Other (please specify)
2	Is the airport operated by an entity other than the owner? If so, is the operator: A municipality or county An authority A state agency (excluding authorities) Other (please specify)
3	Your airport's current ARFF Index under 14 CFR Part 139 is:
4	Identify the aircraft make and model that is the basis for your airport's ARFF Index. (e.g., Boeing 737-300)
5	If your airport is Index B or Index C under Part 139, do you have any scheduled passenger service with Airbus 310 aircraft? Yes ☐ No ☐
6	When are ARFF services normally available at your airport? (e.g., 24 hours, 7 am to 10 pm, 15 minutes before to 15 minutes after each air carrier operation)
7	What is the average response time for the closest fire department located off the airport to provide assistance? ☐ Less than 5 minutes ☐ 5 to 10 minutes ☐ More than 10 minutes ☐ Not Applicable Explanations:

C. Staffing

Note: When considering ARFF staffing, do not include non-firefighting personnel (such as paramedics) who may be assigned to the ARFF unit.

1	How many firefighters do you employ at your airport? Full-time Part-time Total Full-time Equivalents
2	Are firefighters also assigned other duties not related to firefighting (e.g., airfield maintenance) when not performing firefighting duties? Yes ☐ No ☐ If yes, how many firefighters are assigned other duties? What percentage of their time is devoted to firefighting duties? %
3	a. How many firefighters are assigned to a typical shift? (Include officers as well as firefighters.) b. What is your shift structure – 8 hours, 24 hours, etc.?
4	Which of the following applies to the firefighters at your airport: ☐ They are airport employees ☐ They are employees of a city/county fire department ☐ They are members of a military unit (e.g., National Guard, Air Force Reserve, etc.) stationed at the airport ☐ They are employed by a contractor who provides firefighting services to the airport ☐ Other (*please specify*)
5	Are your firefighters trained as structural firefighters, as well as aircraft fire fighters? a. Yes ☐ No ☐ b. If "Yes," is this a state requirement? Yes ☐ No ☐ Not sure ☐ c. Does your fire department respond to structural fires?
6	What standards are your firefighters trained to in identifying, reporting and controlling hazardous materials (HAZMATs)? a. ☐ NFPA 472 Awareness Level b. ☐ NFPA 472 Operations Level c. ☐ NFPA 472 HazMat Technicians d. ☐ NFPA 472 Specialist Employees e. ☐ Other f. ☐ Unknown Comments:
7	Are your firefighters trained for encounters with Weapons of Mass Destruction (WMD)? If so, what standards are they trained to?

D. Infrastructure and Equipment

For each vehicle you use to meet your ARFF Index requirements, please complete the following table. Do not include vehicles that are used solely for structural firefighting purposes. Also, some airport operators keep old vehicles as reserve units in case their other vehicles are down for maintenance or otherwise unavailable—if you include these vehicles please indicate them as a reserve unit in the last column.

Vehicle Type	Year Of Manufacture	Original Cost	Water Capacity (Gal.)	Dry Chemical Capacity (lbs)	Number of Firefighters Assigned to Vehicle	Used as Primary (P) or Reserve (R) Unit?
		$				
		$				
		$				
		$				
		$				
		$				
		$				
		$				
		$				
		$				
		$				

1	How many ARFF stations are located on your airport?
2	If you were required to increase your staffing, how many additional firefighters could be accommodated in your existing facilities?
3	The timed response is normally done under favorable weather and surface conditions. What is average vehicle speed for response in order to meet the timed response at your airport?
4	Is the timed response in 3 (above) to meet Part 139 or a different (e.g. state, municipal, NFPA) guideline? If to a different guideline, please provide more information:

E. Scenarios

Background Information for Scenarios

14 CFR Part 139 requires that certificate holders demonstrate that an ARFF vehicle can reach the midpoint of the farthest runway used for air carrier operations within three minutes and all other required ARFF vehicles reach that same location within four minutes during good visibility and surface conditions. With this information as background, please answer the questions for Scenarios A, B, and C. Assume good visibility and surface conditions (i.e. demonstrated, rather than actual, response times).

Scenario A

1	It has been suggested that the regulatory response time requirement be changed to the farthest runway end. If this change was made, could your existing ARFF vehicles meet the three- and four-minute response times from the existing ARFF station(s)?
2	If not, is there any feasible location on the airport where the ARFF station could be sited that would allow the existing vehicles to meet the three and four minute response times to the ends of all runways used by air carriers?
3	If the answer to the preceding question is "no," how many additional ARFF stations would you need to meet this requirement?

Scenario B

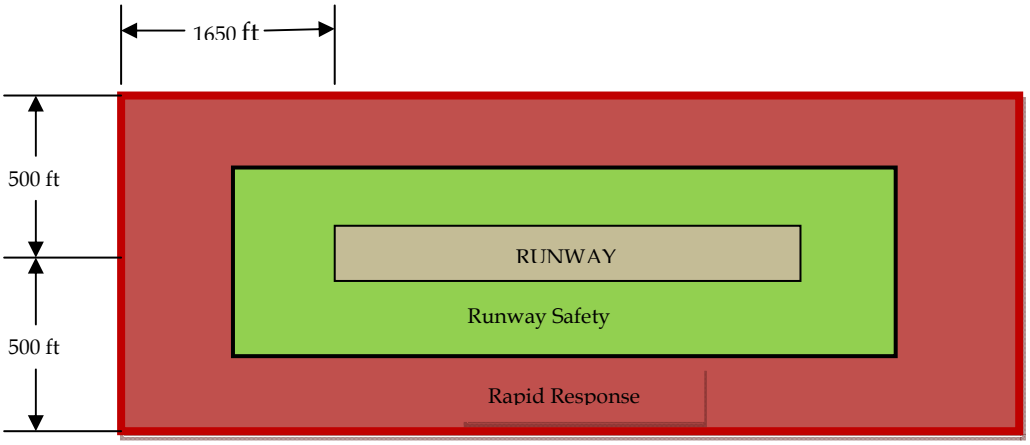
4	It has also been suggested that the regulatory requirement be changed to **the farthest runway end and the response times for all required vehicles be changed to TWO minutes.** If this change was made, could your existing ARFF vehicles meet the two-minute response times from the existing ARFF station(s)?
5	If not, is there any feasible location on the airport where the ARFF station could be sited that would allow all the required vehicles to meet the two-minute response time to the ends of all runways used by air carriers?
6	If the answer to the preceding question is "no," how many additional ARFF stations would you need to meet this requirement?

Scenario C

7	It has also been suggested that the regulatory requirement be added that a certificate holder would be able to demonstrate that **an ARFF vehicle can respond to any point on a taxiway or ramp/apron within three minutes.** If this requirement was adopted, could your existing ARFF vehicles meet the three-minute response times from the existing ARFF station(s)?
8	If not, is there any feasible location on the airport where the ARFF station could be sited that would allow all the required vehicles to meet the three-minute response time to any point on the taxiways or ramp/apron?
9	If the answer to the preceding question is "no" how many additional ARFF stations would you need to meet this requirement?

F. Rapid Response Area

Establishment of a rapid response area (RRA) surrounding each runway is also being considered. As shown in the diagram, this area would have a width of 1000 feet (500 feet each side of the runway centerline and extend 1650 feet beyond each runway end. It is proposed that any point in this RRA ***that is located on airport property*** *would be accessible to ARFF vehicles. It is proposed that the first responding vehicle would be able to reach any point in the on-airport RRA within 2 ½ minutes during conditions of optimum visibility and surface conditions with other required ARFF vehicles arriving in 30 second intervals.*
Note: The dimensions of the Rapid Response Area are the same for all runways (i.e., the RRA does not change in size based on type of aircraft as does the RSA).



With the preceding background please answer the following questions for each runway (that is used by an air carrier at your airport) by completing the following table. **Remember the questions are only applicable to the portion of the RRA that is located on airport property. Enter answers for each runway in table that follows.**

1. Are all points within the on-airport RRA accessible to an ARFF vehicle, i.e., could an ARFF vehicle drive to any point within the RRA under optimum visibility and surface conditions?

2. If all points in on-airport RRA are not accessible to an ARFF vehicle, would you classify the work needed to make it accessible as minor or major? Minor work is considered removal of brush, some grading, etc. Major work is considered to include any of the following: substantial grading, establishing or relocating drainage flows or retention ponds, removal of a large quantity of substantial vegetation (e.g., large trees), relocation of a wetland.

3. If all points in the on-airport RRA are or were made accessible to ARFF vehicles, could the first responding vehicle during a demonstration in optimum conditions of visibility and surface conditions reach all these points within 2 ½ minutes?

4. Does your runway safety area currently meet FAA design standards?

Table of Answers to RRA Questions

Runway ID, e.g., 1-19	Answer to Question 1	Answer to Question 2	Answer to Question 3	Answer to Question 4
	Yes or No	Major or Minor	Yes or No	Yes or No

G. Costs

Firefighting Drill Costs

1a	What is the estimated cost for each firefighter at your airport to receive annual hot fire training? Include such costs (as applicable) as tuition or fees to use the facility, lodging, per diem, travel costs, overtime to provide ARFF coverage at airport during training, and any costs associated with bringing a mobile trainer to the airport. Total estimated annual cost per firefighter: $
1b	If the firefighters are trained on the airport using a mobile trainer to receive annual hot fire training, what is the estimated cost for each firefighter at your airport? Include such costs as rental of the trainer, lodging for the operators of the trainer, propane used, etc. Total estimated annual cost per firefighter: $

Under 14 CFR Part 139 an airport is required to have a full-scale exercise of its emergency plan every three years and a tabletop exercise during the intervening years. These exercises are often held in conjunction with emergency responders from surrounding jurisdictions.

Full-scale Exercise Costs

2	Please provide your best estimate of the **cost to the airport** for the last full-scale exercise that was held. $
3	Please provide your best estimate of the **total cost** (i.e., cost to airport plus cost to other participating jurisdictions) for the last full-scale exercise that was held. $
4	In what year was the last full-scale exercise held?

Table Top Exercise Costs

5	Please provide your best estimate of the **cost to the airport** for the last tabletop exercise that was held. $
6	Please provide your best estimate of the **total cost** (i.e., cost to airport plus cost to other participating jurisdictions) for the last tabletop exercise that was held. $

ARFF Costs

<table>
<tr><td>7</td><td>What is the average annual salary of a firefighter at your airport? $</td></tr>
<tr><td>8</td><td>What is the average annual cost per firefighter to the airport, including benefits (e.g., health insurance, retirement, etc.) training and employer taxes in addition to annual salary? $</td></tr>
<tr><td>9</td><td>Excluding capital costs, how much do you spend on ARFF operations each year? Capital costs include facility development and equipment procurement. Capital costs do NOT include staffing, training, regular facility maintenance and operations or vehicle maintenance. $</td></tr>
<tr><td>10</td><td>Please provide a percentage breakdown for all ARFF costs by funding source and type for the most recent year available (unless the most recent year was atypical, in which case use the most recent typical year). Please make the sum of each column equal 100%.
<table>
<tr><th>Funding Source</th><th>Capital Costs</th><th>Operating Costs</th></tr>
<tr><td>AIP</td><td>%</td><td>%</td></tr>
<tr><td>State</td><td>%</td><td>%</td></tr>
<tr><td>Airport</td><td>%</td><td>%</td></tr>
<tr><td>Other (please specify)

</td><td>%</td><td>%</td></tr>
<tr><td>Total</td><td>100%</td><td>100%</td></tr>
</table></td></tr>
<tr><td>11</td><td>Is the amount being charged for ARFF services readily identifiable in your rates and charges?
a) If yes, please provide existing cost recovery formula.
b) If not, what percentage of your total airport operations costs are ARFF operations costs?</td></tr>
<tr><td>12</td><td>What are the normal rates and charges formulae for various types of aircraft operating at your airport?</td></tr>
<tr><td>13</td><td>What are the current landing fees? $</td></tr>
<tr><td>14</td><td>Are there any other ARFF costs at your airport that we have not identified?
No ☐ Yes ☐</td></tr>
<tr><td>15</td><td>What is the amount included in your budget for all airport operational expenses including ARFF operations? $</td></tr>
</table>

H. ARFF Responses To Incidents

Please complete the following table for each of the identified incidents. Do not include any responses that were solely responses to medical events. Please do not double count, e.g., if ARFF responded to a cargo incident involving hazardous materials this event should be counted only once as either a hazardous material or a cargo incident.

Type of Incident	Does Your ARFF Respond to this Incident Type?*	Number of ARFF Responses to this Type of Incident During a 12-month period**	Additional Remarks
Aircraft Incident/ Accident on the Airfield (include Alert 1 (standby at the station), Alert 2 (standby on the field), as well as Alert 3 (accident response)			
Aircraft Fuel Spills			
Hazardous Materials other than Aircraft Fuel Spills			
Automobile Parking Lot/ Garage Incidents			
Cargo Incidents			
On-airport Structural Incidents			
Mutual Aid to Jurisdictions Outside the Airfield			
Other (please specify)			

*If your ARFF department does not respond to a particular type of incident please identify who the responder is, (e.g., a fire in the terminal building may be responded to by the local jurisdiction's fire department).

** For the 12-month response column, please indicate the number of responses for the 12-month period for which you have records—in some cases this may mean a twelve-month period different than a calendar year or fiscal year.

APPENDIX D
COST FACTORS

Firefighter salaries are an ongoing cost of increasing ARFF standards, and represent the largest type of cost in the scenarios examined. Costs are based on salary and benefit figures provided by the interviewed airports. Figure D-1 shows that the NFPA 2-Minute scenario has the highest salary costs, followed by the NFPA 3-Minute scenario.

Figure D-1: Annual Firefighter Salary Costs

Firefighter Salaries								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$7.2	$6.1	$41.2	$44.4	$47.7	$111.6	$258.2
	Sat	$7.2	$6.1	$41.2	$44.4	$19.1	$44.7	$162.6
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$12.4	$0.0	$0.0	$0.0	$12.4

Firefighter Salaries								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$28.6	$126.0	$207.6	$201.3	$166.6	$365.4	$1,095.5
	Sat	$28.6	$126.0	$207.6	$201.3	$66.6	$146.2	$776.3
NFPA 3-Minute Movement Area Demonstration	Full	$13.2	$123.0	$207.4	$162.6	$86.4	$223.4	$816.0
	Sat	$13.2	$123.0	$207.4	$162.6	$39.8	$89.3	$635.4
NFPA Minimum Staff/Vehicles Requirement		$20.9	$111.3	$205.5	$145.1	$45.7	$17.2	$545.7

Full assumes that additional stations are "full," standalone stations.

Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.

*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Employee turnover costs represent the Initial Training and Equipment expense for new firefighters, to replace those who leave. Firefighters brought on to meet ICAO/ NFPA requirements are assumed to be replaced at 20 percent per year. This means that annual turnover costs are one-fifth of Initial Training and Equipment costs. Figure D-2 shows that these costs are highest at Index E and Index B airports, and are highest for the NFPA 2-Minute scenario.

Figure D-2: Annual Employee Turnover Costs

Annual Employee Turnover Costs								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$0.2	$0.2	$1.2	$1.1	$1.0	$2.1	$5.8
	Sat	$0.2	$0.2	$1.2	$1.1	$0.4	$0.8	$3.9
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$0.3	$0.0	$0.0	$0.0	$0.3

Annual Employee Turnover Costs								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$1.0	$3.8	$6.5	$5.6	$4.5	$8.4	$29.9
	Sat	$1.0	$3.8	$6.5	$5.6	$1.8	$3.4	$22.1
NFPA 3-Minute Movement Area Demonstration	Full	$0.6	$3.7	$6.2	$4.3	$1.4	$4.8	$21.0
	Sat	$0.6	$3.7	$6.2	$4.3	$0.7	$1.9	$17.4
NFPA Minimum Staff/Vehicles Requirement		$0.7	$3.4	$6.1	$3.9	$0.7	$0.4	$15.3

Full assumes that additional stations are "full," standalone stations.

Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.

*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Firefighting vehicles added to meet ICAO/NFPA requirements are depreciated over a period of 15 years, with a ten percent residual value. This means that the annualized investment cost is six percent of the initial vehicle cost. Figure D-3 shows that depreciation is largest at Index E and Index C airports, and is larger for the NFPA 2-Minute scenario than the other scenarios.

Figure D-3: Annual Investment Cost for Additional Vehicles ($millions)

Annual Investment Cost for Additional Vehicles								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$0.4	$0.2	$3.8	$3.7	$3.2	$5.8	$17.1
	Sat	$0.4	$0.2	$3.8	$3.7	$1.3	$2.3	$11.7
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$2.1	$0.0	$0.0	$0.0	$2.1

Annual Investment Cost for Additional Vehicles								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$0.7	$1.8	$9.0	$16.8	$13.9	$21.6	$63.8
	Sat	$0.7	$1.8	$9.0	$16.8	$5.5	$8.6	$42.5
NFPA 3-Minute Movement Area Demonstration	Full	$0.0	$1.2	$4.1	$5.9	$4.0	$14.4	$29.6
	Sat	$0.0	$1.2	$4.1	$5.9	$1.6	$5.8	$18.6
NFPA Minimum Staff/Vehicles Requirement		$0.0	$1.0	$2.4	$0.6	$0.0	$0.0	$4.0

Full assumes that additional stations are "full," standalone stations.

Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.

*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Fuel and maintenance costs represent the operating costs of firefighting vehicles added to meet ICAO/NFPA requirements. These costs are assumed to equal five percent of the initial cost of the vehicle. Figure D-4 shows that these costs are highest at Index E and Index C airports, and are higher for the NFPA 2-Minute scenario than the other scenarios.

Figure D-4: Annual Fuel and Maintenance Costs for Additional Vehicles ($millions)

Annual Fuel and Maintenance Costs for Additional Vehicles								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$0.3	$0.2	$3.2	$3.1	$2.6	$4.8	$14.2
	Sat	$0.3	$0.2	$3.2	$3.1	$1.1	$1.9	$9.8
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$1.7	$0.0	$0.0	$0.0	$1.7

Annual Fuel and Maintenance Costs for Additional Vehicles								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$0.6	$1.5	$7.5	$14.0	$11.6	$18.0	$53.1
	Sat	$0.6	$1.5	$7.5	$14.0	$4.6	$7.2	$35.4
NFPA 3-Minute Movement Area Demonstration	Full	$0.0	$1.0	$3.5	$4.9	$3.3	$12.0	$24.7
	Sat	$0.0	$1.0	$3.5	$4.9	$1.3	$4.8	$15.5
NFPA Minimum Staff/Vehicles Requirement		$0.0	$0.8	$2.0	$0.5	$0.0	$0.0	$3.4

Full assumes that additional stations are "full," standalone stations.

Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.

*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Fire stations added to meet ICAO / NFPA requirements are depreciated over a period of 30 years. Annualized investment costs are therefore 1/30, or 3.33%, of the initial construction cost. Figure D-5 shows that depreciation is largest at Index E and Index C airports, and is larger for the NFPA 2-Minute scenario than the other scenarios.

Figure D-5: Annual Investment Cost for Additional Fire Stations ($millions)

Annual Investment Cost for Additional Fire Stations								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$3.3	$1.6	$4.0	$9.1	$4.0	$9.6	$31.5
	Sat	$3.3	$1.6	$4.0	$9.1	$1.5	$2.8	$22.3
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Annual Investment Cost for Additional Fire Stations								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$5.7	$8.7	$12.9	$23.4	$17.3	$36.0	$104.1
	Sat	$5.7	$8.7	$12.9	$23.4	$6.7	$10.5	$68.0
NFPA 3-Minute Movement Area Demonstration	Full	$1.9	$1.6	$5.0	$9.1	$7.4	$24.0	$49.0
	Sat	$1.9	$1.6	$5.0	$9.1	$2.9	$7.0	$27.4
NFPA Minimum Staff/Vehicles Requirement		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Full assumes that additional stations are "full," standalone stations.

Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.

*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Additional fire stations incur costs for utilities and maintenance. These are assumed to equal five percent of the initial construction costs each year. Additional fire stations, those which represent an increase in the number of fire stations on the airport, produce increased utility and maintenance costs. Relocated fire stations, which are newly-built replacements of previous fire stations to improve response times, do not produce increased utility and maintenance costs. Therefore, the costs shown in Figure D-6 do not correlate directly with station construction costs shown in the body of the report. Utility and maintenance costs are highest for Index E and Index C airports, and for the NFPA 2-Minute scenario.

Figure D-6: Annual Utility and Maintenance Costs for Additional Fire Stations ($millions)

Annual Utility and Maintenance Costs for Additional Fire Stations								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$2.5	$1.2	$4.5	$7.8	$5.9	$14.4	$36.3
	Sat	$2.5	$1.2	$4.5	$7.8	$2.3	$4.2	$22.5
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Annual Utility and Maintenance Costs for Additional Fire Stations								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$4.2	$7.1	$17.3	$35.1	$26.0	$54.0	$143.7
	Sat	$4.2	$7.1	$17.3	$35.1	$10.1	$15.8	$89.6
NFPA 3-Minute Movement Area Demonstration	Full	$0.0	$2.4	$6.0	$11.7	$7.4	$36.0	$63.5
	Sat	$0.0	$2.4	$6.0	$11.7	$2.9	$10.5	$33.4
NFPA Minimum Staff/Vehicles Requirement		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Full assumes that additional stations are "full," standalone stations.
Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.
*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

Annual Operating and Investment Cost represents the total annualized cost of the scenarios examined, and is shown in Figure D-7. As such, it is the sum of costs in Figures D-1 through D-6. Index B, Index C and Index E airports have the highest total cost levels, depending on the scenario. The NFPA 2-Minute scenario has the highest level of cost overall.

Figure D-7: Annual Operating and Investment Cost ($millions)

Annual Operating and Investment Cost								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
ICAO 3-Minute Runway Response Time Demonstration	Full	$14.0	$9.4	$57.8	$69.3	$64.4	$148.3	$363.1
	Sat	$14.0	$9.4	$57.8	$69.3	$25.6	$56.7	$232.8
ICAO Minimum Staff/Vehicles Requirement*		$0.0	$0.0	$16.5	$0.0	$0.0	$0.0	$16.5

Annual Operating and Investment Cost								
$ Millions		**IIIA/IIA**	**IA**	**IB**	**IC**	**ID**	**IE**	**Total**
NFPA 2-Minute Runway Response Time Demonstration	Full	$40.8	$148.9	$260.8	$296.3	$239.8	$503.4	$1,490.1
	Sat	$40.8	$148.9	$260.8	$296.3	$95.5	$191.6	$1,033.9
NFPA 3-Minute Movement Area Demonstration	Full	$15.7	$132.9	$232.2	$198.6	$109.9	$314.6	$1,003.7
	Sat	$15.7	$132.9	$232.2	$198.6	$49.2	$119.3	$747.8
NFPA Minimum Staff/Vehicles Requirement		$21.6	$116.4	$216.0	$150.2	$46.5	$17.6	$568.3

Full assumes that additional stations are "full," standalone stations.
Sat assumes that additional stations at Index D and Index E airports are smaller "satellite" stations.
*ICAO does not have a minimum staffing requirement, but additional vehicles require additional staff at some airports.

APPENDIX E
ANALYTIC METHODOLOGY

E.1 INTRODUCTION

This research effort was undertaken by GRA, Incorporated for the Airport Cooperative Research Program (ACRP) to provide information that can be used to assess the potential costs of more closely aligning airport rescue and fire fighting regulations under Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports, with standards promulgated by the International Civil Aviation Organization (ICAO) and the National Fire Protection Association (NFPA). The research results represent an independent analysis by the GRA Team, with guidance from ACRP staff and review by an informal working group with subject matter expertise.

At the outset of the project, GRA prepared a draft work plan for review by the working group and revised the approach based on comments from them.[2] The work program consisted of the following five tasks:

- Task 1—Develop Final Study Plan and Other Materials
- Task 2—Literature Review
- Task 3—Conduct Airport Research
- Task 4—Complete Initial Analysis and Submit Draft Report
- Task 5—Respond to Feedback and Develop Project Final Report

The airport research was conducted through a series of telephone interviews with various sizes and types of airports that hold Part 139 certificates for passenger air carrier flights. Operators of Part 139 airports are required to meet certain aircraft rescue and fire fighting (ARFF) standards.[3] The interviews were used to obtain information from airports on current ARFF practices, in terms of facilities, equipment and staffing. Data were also requested for existing ARFF response times to various parts of the airport and surrounding areas. The interviews used scenarios that reflected ICAO and NFPA standards. These data were used in the analysis to examine the cost impact of changes to ARFF standards. The analysis does not examine impacts of extending ARFF to airports that are not currently required to hold Part 139 certificates.

[2] The draft work plan was submitted on 12-10-2008 and a revised plan was submitted on 1-10-2009. In addition, GRA provided detailed responses to the working group's questions on the original and revised work plans.

[3] Part 139 of Title 14, CFR, requires airports that serve: 1) scheduled passenger-carrying operations of an air carrier operating aircraft designed for more than nine passenger seats; and 2) unscheduled passenger-carrying operations of an air carrier operating aircraft designed for at least 31 passenger seats, to receive operating certificates from the Federal Aviation Administration (FAA).

At present, there are 562 airports that hold Part 139 certificates, including 86 that have Class IV certificates.[4] This research focused on the 476 airports that hold Class I, II and III certificates, because Class IV certificates apply to airports that only have unscheduled service with aircraft having more than 30 passenger seats. Figure E-1 shows the distribution of airports by index and class.

Figure E-1: Number and Distribution of Part 139 Airports by Index and Class

Airport Class	Index*	Population	Percentage
Total		**476**	**100.0%**
Class III	A	42	7.5%
Class II	A	57	10.1%
Class I	A	131	23.3%
Class I	B	111	19.8%
Class I	C	78	13.9%
Class I	D	33	5.9%
Class I	E	24	4.3%

*There were 17 Class III and two Class I airports with no index listed; these were assigned to Index A.

E.2 PROJECT SCOPE

There have been recent legislative proposals to investigate changing ARFF requirements.[5] These proposals require that FAA consider changing its regulations to bring them in line with voluntary industry consensus standards. However, the potential impacts of these actions on airports, airlines and the flying public have not been assessed. This analysis estimates the costs and benefits of requiring Part 139 airports to comply with certain NFPA standards and ICAO fire fighting standards. The ACRP undertook this project to gather data that could inform the discussion of proposals to change ARFF standards. The objectives of this research are to:

- Compare the current FAA requirements for ARFF to the proposed NFPA and ICAO standards.
- Provide a financial analysis of the operational costs for airports to comply with the NFPA and ICAO standards to the extent that they differ from the costs associated with the current FAA requirements; including assessments and discussions on:
  - Initial costs to implement or start-up these new standards
  - Continuing cost to provide these ARFF services

[4] These data were downloaded from FAA's website, and are current as of 2-9-09. It is not uncommon for these numbers to change slightly as airports receive or relinquish Part 139 certificates. There are 15 airports with inactive certificates included in the total of 562 airports.
[5] See Section 311 of H.R. 915 EH, ***FAA Reauthorization Act of 2009***.

- Implications for cost by size of airport and cost per enplaned passenger "CPE"

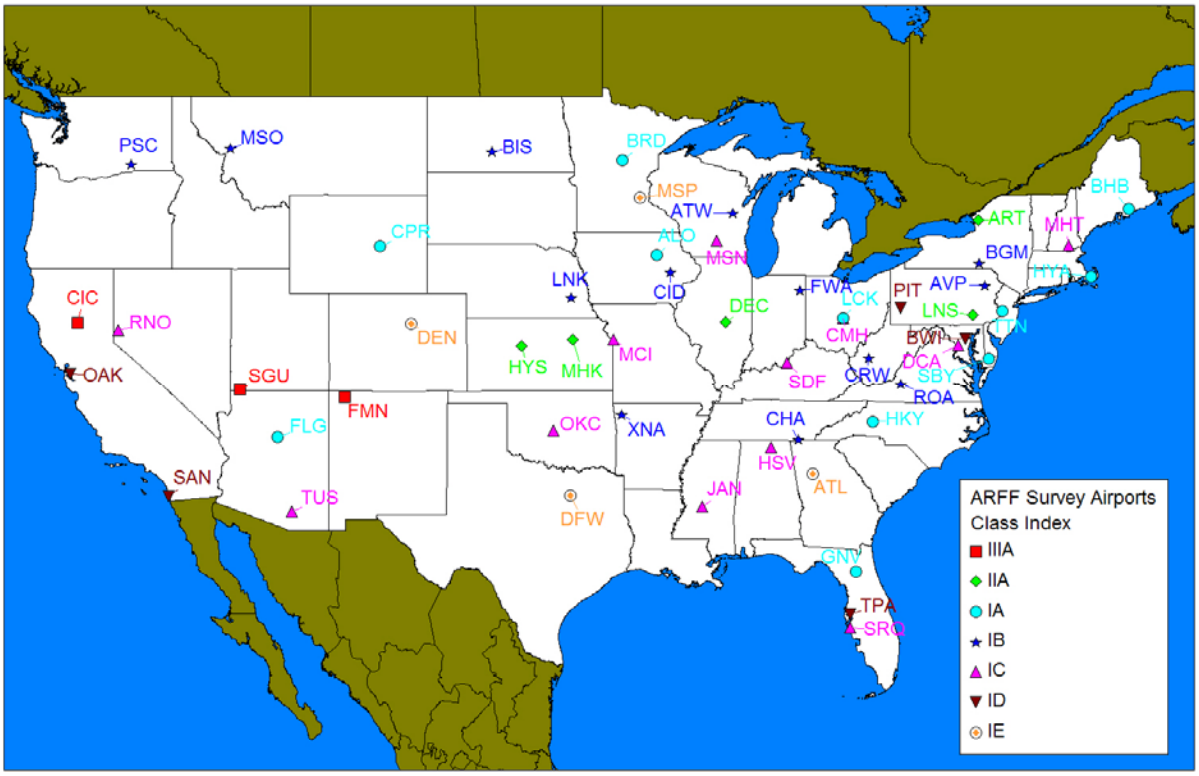
- Provide a financial analysis of the infrastructure and equipment costs for airports to comply with the NFPA and ICAO standards to the extent that they differ from the costs associated with the current FAA requirements.

- Provide an analysis of the cost of NFPA and ICAO standards compared to the cost and level of safety currently required.[6]

E.3 RESEARCH APPROACH

The general approach to gathering the necessary data for this project was to conduct interviews with a selected number of Part 139 airports. The 53 airports interviewed are shown in Figure E-2.

Figure E-2: Airports Interviewed



[6] ACRP, Revised Scope of Work, **ACRP 11-02 / Task 11 Quick Response Project to Examine How Proposed ARFF Standards Would Impact Airports** (provided by ACRP via email 12-18-08), as modified by the working group during review of the plan.

The interview questions were designed to provide a comparison of the existing ARFF requirements in Part 139 with the standards in ICAO Annex 14 and NFPA 403. The airports were asked to estimate the numbers of additional fire stations, firefighters and vehicles that would be needed to meet reductions in demonstrated ARFF response times to different locations on the airport, to cover an increased response area and to meet other training-related standards. The staffing data were used to calculate the number of additional firefighters needed to meet NFPA minimum staff requirements at airports holding Part 139 certificates. The Interview Guide Response Form is contained in Appendix C.

Section 2 compares FAA, ICAO and NFPA ARFF requirements. Section 3 presents an analysis of prior accidents to assess how increased ARFF requirements would reduce the mortality of aircraft accidents.

One of the first steps of the research was to identify FAA, ICAO and NFPA ARFF requirements. The research in this area involved comparing the FAA's current requirements for ARFF which are contained in 14 Code of Federal Regulations (CFR) Part 139 with the standards set forth in the International Civil Aviation Organization's Annex 14 and the National Fire Protection Association's standards that are contained primarily in their document NFPA 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports. Other NFPA documents referenced in NFPA 403 were consulted when necessary. The results of this research are found in Section 2 of the report.

One item worthy of mention is that both Annex 14 and NFPA 403 use aircraft length and width to determine the ARFF Category of coverage while Part 139 considers only aircraft length to make this determination. The research of air carrier aircraft flown in the United States revealed that only one aircraft had a width that would require an upgrade of the ARFF Category of coverage. That aircraft, the Airbus 310, is not used in air carrier passenger service in the United States. Consequently, consideration of aircraft width does not have any effect on determining the ARFF Category of coverage. A listing of aircraft reviewed along with their dimensions is contained in Appendix B of this report.

An analysis of prior accidents was used to assess the potential for increased ARFF requirements to reduce the mortality of aircraft accidents. The research team reviewed National Transportation Safety Board briefs and reports of fatal air carrier accidents from January 1, 1997 to December 31, 2007. The review included scheduled and unscheduled operations of carriers operating under Part 121 and scheduled operations of Part 135 carriers using aircraft with more than nine seats. The research team's observations were based upon the NTSB findings for these accidents.

E.4 DATA COLLECTION AND ANALYSIS

The airport interview program was designed to obtain the data necessary to assess the impacts on airports if they had to comply with new regulations that were more closely aligned with ICAO and/or NFPA ARFF standards. The set of airports to be interviewed was determined based on an analysis of the differences between Part 139 and the ICAO-NFPA standards, and their likely effect on various classes of airports.

A list of airports certified under Part 139 is contained in Appendix A. Based on the comparison of ICAO/NFPA standards with the existing Part 139 described in Section 2, the interviews obtained information from airport operators that held Class I, II, or III Operating Certificates. The ARCP Working Group's inputs were used to develop the Interview Guide Response Form (see Appendix C). The working group also provided assistance in identifying airports to include in the research, as well as identifying specific contact points at these airports. Given the large number of airports and differences in Part 139 requirements, the set of airports selected for interviews provided coverage of the ARFF classes and index numbers, as well as a reasonable geographic distribution. Interviews were limited to airports in the Continental U.S; airports in Alaska and Hawaii as well as airports in U.S. territories were excluded.

There are 476 Part 139 Class I, Class II and Class III airports in total. The team set an objective of contacting 60 airports (12.5 per cent) with a goal of obtaining completed responses from at least 40 airports (8.4 percent). The team looked for geographic and ownership diversity in selecting candidates for interviews. As a general rule, no more than one airport was selected from a single state for any particular Class I Index, or for Class II and III airports. The team also attempted to limit the total number of airports from any one state in the data gathering effort to no more than three.[7] Given the available resources and level of detailed information required, the approach used a judgment-based sample and not a probabilistic design. Using a pro rata share of the 60-airport sample, Figure E-3 shows the distribution of airports initially identified for interviews and the number and percentage actually completed for each Class and Index. Overall, interviews were completed with 53 of the airports (11.1 percent).

[7] The initial list of airports is contained in Figure 1 (see pg. 4) of the Draft Final Work Plan (revised 1-10-09).

Figure E-3: Airport Population and Interviews Completed

Airport Class	Index	Population	Airports Initially Identified	Airport Interviews Completed	Percent of Population Completed
Total		**476**	**60**	**53**	**11.1%**
Class III	A	42	6	3	7.1%
Class II	A	57	7	5	8.8%
Class I	A	131	16	11	8.4%
Class I	B	111	14	13	11.7%
Class I	C	78	10	12	15.4%
Class I	D	33	4	5	15.2%
Class I	E	24	3	4	16.7%

A project database was used to record the information obtained during the interviews as well as related information. Financial information was obtained from FAA Form 5100-127, Operating and Financial Summary, which airports provide to FAA.[8] Annual enplanements data are from information collected by the U.S.DOT.[9]

Data on the costs of employees, ARFF vehicles and equipment, and fire stations were obtained from airport interviews and other sources. These were used in conjunction with the interview data to develop cost estimates for the NFPA and ICAO standards. Based on data from the airport interviews on the potential cost impacts of using ICAO and/or NFPA standards as a basis for ARFF regulations in the U.S., the greatest impacts were in three areas:

- The NFPA definition and coverage of a rapid response area, parts of which may not be currently accessible without improvements.
- ICAO and NFPA standards that specify minimum numbers of staff and ARFF vehicles at each category of airports.
- Changed response times that drive the need for additional/relocated fire stations. The costs of firefighters and trucks that would be at the additional stations were also estimated. These changes apply to both NFPA and ICAO, although they call for different standards.

The analysis includes estimates of operating cost impacts, as well as any needed investments that would result from adoption of ICAO or NFPA standards. The incremental impacts are measured over and above the ARFF services provided

[8] Data obtained from FAA's CATS system on March 29, 2009. Data was used from FY 2008 for the airports. If no FY 2008 data have been reported data from FY 2007 was used.
[9] Enplanements data are from Bureau of Transportation Statistics' T-100 data for domestic and international flight segments. Data from 2008 was used for all airports except BHB and LNS where 2007 data was used.

currently, which may exceed Part 139 requirements. A key to the numbers and locations of airport fire stations and associated staffing requirements are the locations that must be reached and the time allowed for the ARFF response to those locations during demonstrated ARFF response drills. The analysis assumes that airports meet the standards for the minimum numbers of ARFF vehicles (ICAO and NFPA) and the number of firefighters (NFPA), when estimating the cost of response time requirements.

Based on the average impact for each airport group (defined by index and class), the results were expanded to the 476 Class I, II, and III Part 139 airports. Impacts are reported both as absolute costs and as a cost per enplaned passenger. The report identifies initial investment costs and annual operating costs. In addition, initial investment costs are converted to annual costs.