

# **THE AASK DATABASE V3.0: A Database of Human Experience In Evacuation Derived from Air Accident Reports.**

By

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# The Need For Data

- Associated with the development of computer evacuation models is the need for data in order to:
  - *IDENTIFY* physical, physiological and psychological processes
  - *QUANTIFY* attributes/variables associated with the processes
  - *PROVIDE* data for model validation
  - Examples: *exit hesitation, route planning, exit recommittal, travel speeds, effect of companions, etc.*
- Regardless of model development, essential to understand what actually happens to passengers during aircraft accidents.



# The Need For Data

- **What are the main sources of Data?**
- Three Main Data Sources
  - aircraft accident reports
  - aircraft certification reports/videos
  - experiments, e.g. Cranfield University/FAA CAMI Trials
- Each Source Provides Useful and Unique Data
  - e.g. experiments more useful for validation than accident reports
- FSEG Undertaking Large Data Extraction Exercise From *All THREE* Sources
  - this paper considers aircraft accident reports



# Aircraft Accident Reports

- Analysis of human factors data is complex and time consuming
  - mainly due to corroboration process
- While the analysis of a single accident is difficult, it is even more difficult to perform cross accident analyses.
- To aid in this process, **AASK** was developed.
  - **A**ircraft **A**ccident **S**tatistics and **K**nowledge
  - store and analyse pax and crew evacuation experience



# AASK: Development

- **AASK V1.0**
  - Feasibility study involving small number of accidents
  - detailed human factors, i.e. individual accounts
  - range of accident scenarios
  - iterative analysis process lead to basic database structure
- **AASK V2.0**
  - support from UK CAA lead to the refinement of database.
  - Additional accidents added to database
  - First analyses conducted
  - reported at the last Cabin Safety Conference.
- Continued support from the UK CAA has lead to the development of **AASK V3.0.**



# AASK V3.0: Features

- **Additional accidents included.**
- **New Fields added to all components**
- **Redesigned structure improving efficiency**
- **Seat Plan Viewer**
  - Quick visualisation of cabin layout
  - exit usage and fatality location options
- **Internet Capability**
- **Query Engine**
  - Facilitating data mining and analysis
  - For use in stand alone and internet implementations





# AASK V3.0 : Additional Data

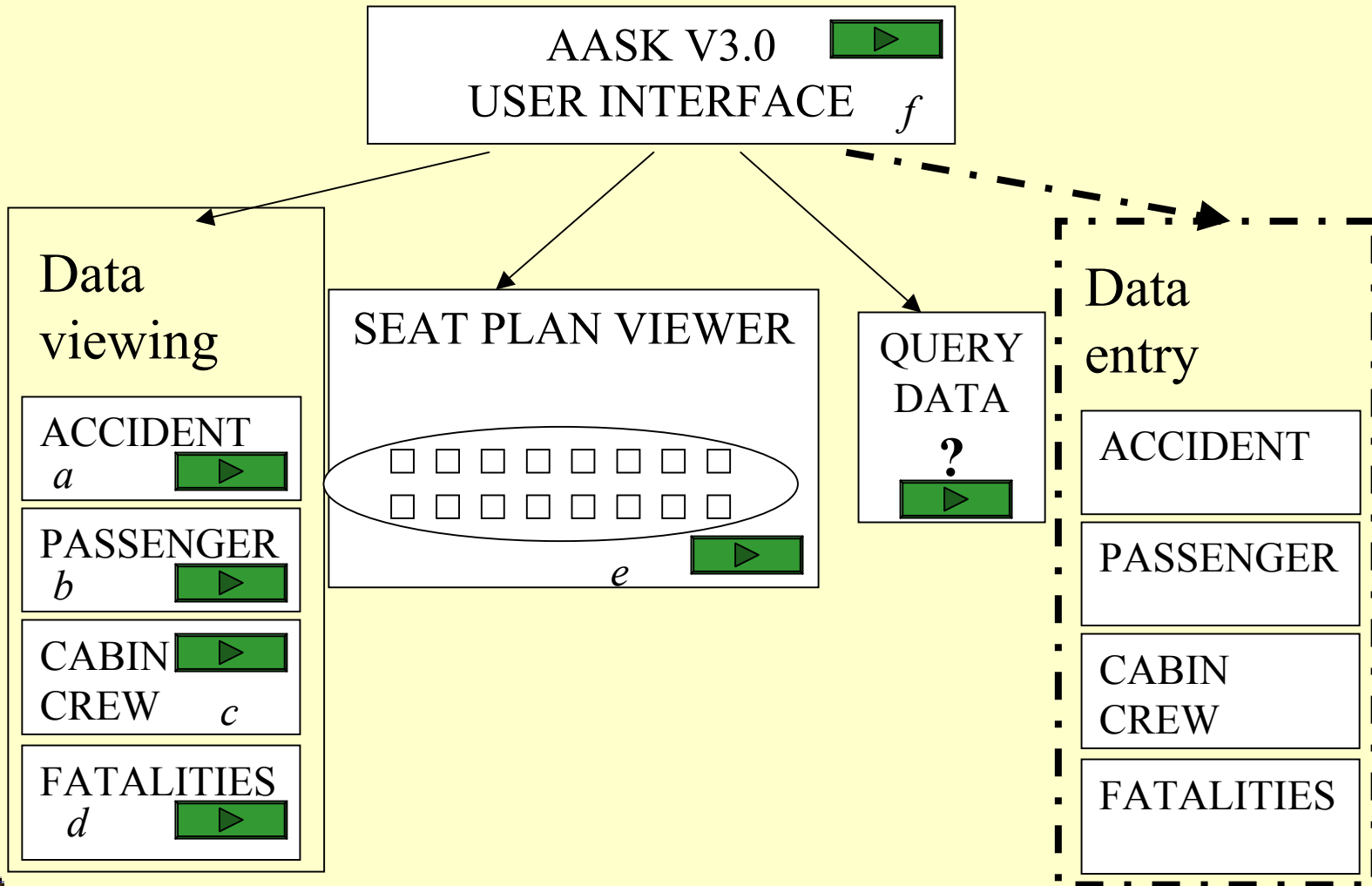
- **Additional accident data included**

	<b>AASK V2.0</b>	<b>AASK V3.0</b>
<b>Accidents</b>	<b>25</b>	<b>55</b>
<b>Pax accounts</b>	<b>669</b>	<b>1295</b> (4855 survivors)
<b>Crew accounts</b>	<b>0</b>	<b>110</b>
<b>Fatalities</b>	<b>0</b>	<b>327</b> (679 fatalities)

–Data in AASK 3.0 covers the period from 04/04/77 to 18/03/98



# AASK V3.0 : Database Structure



# AASK Examples

- **Basic Survivor/Reply Rate Analysis**

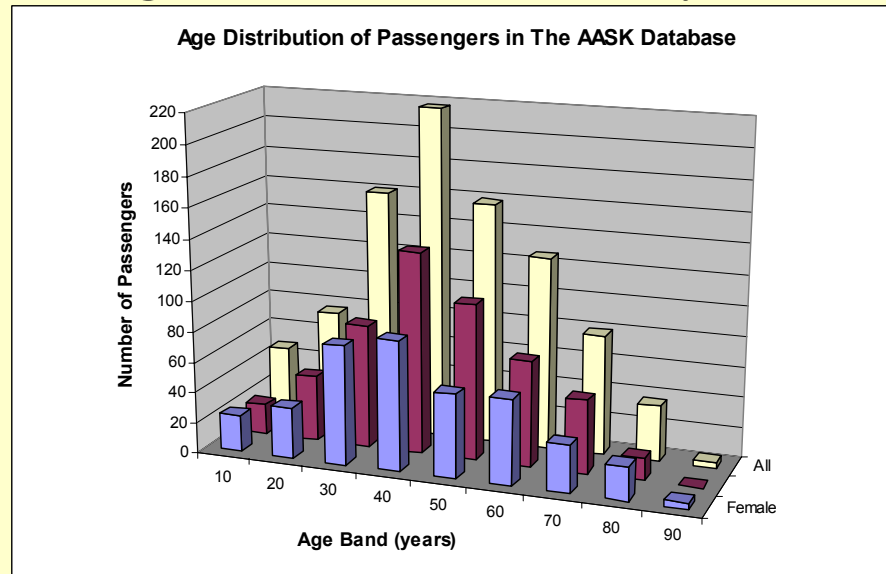
Date	Aircraft	Location	Pax	Pax Load	Surv. Rate	Reply Rate	Accident Type
01/23/82	DC10	Logan INT. A/P Boston	197	55%	99.0%	3.1%	Ruptured, In Water
09/01/83	CV580	Brainerd A/P, Minnesota	30	60%	96.7%	69.0%	Intact, No Fire
02/06/83	DC9	Greater Cincinnati Int. A/P	41	41%	43.9%	77.8%	In-flight, Internal Fire
08/22/85	B737	Manchester A/P England	131	96%	59.5%	96.2%	Intact, Internal Fire
10/25/86	B737	Charlotte Douglas Int. A/P	114	66%	100.0%	99.1%	Intact, No Fire
11/15/87	DC9	Stapleton Int. A/P, Colorado	77	93%	67.5%	76.9%	Ruptured, No Fire
04/15/88	DHC8	Seattle-Tacoma INT A/P	37	100%	100.0%	75.7%	Ruptured, Ext Fire

- Example cross-accident analysis
- Survival rates high -only consider survivable accidents!
- Reply rate very variable
- Important to know # paxs for which there is *NO* data!



# AASK: Age Distribution

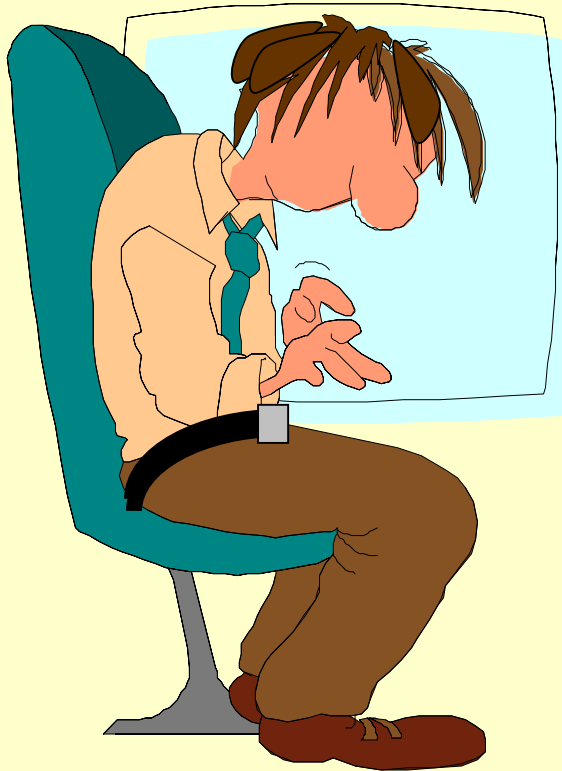
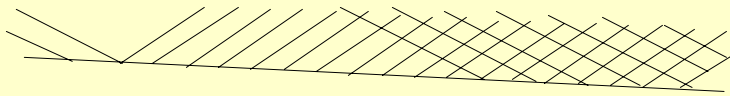
- Basic Passenger Attribute Analysis: Known Ages



- Mean age of all survivors = 39.4 years
- Attributes may be cross categorised, e.g. by gender
- Mean female survivor age = 39.3 years
- Mean male survivor age = 39.8 years



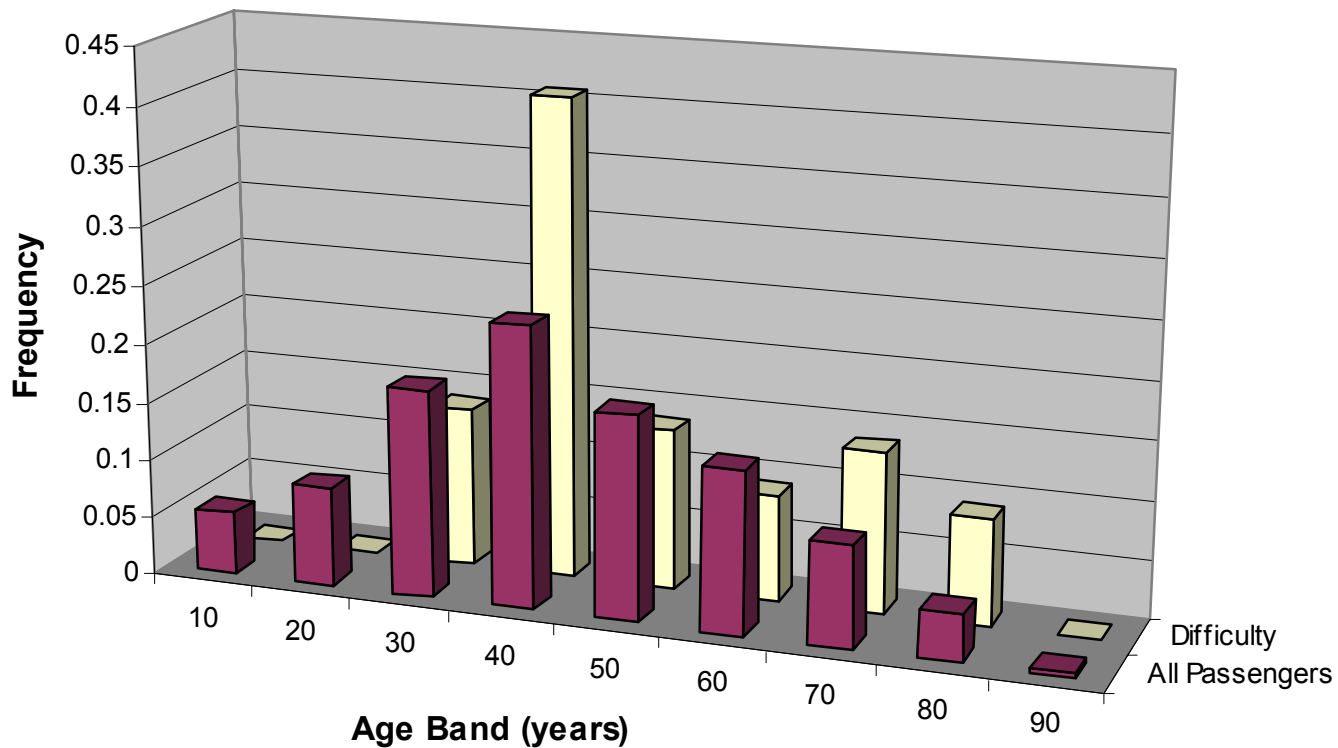
# AASK: Seatbelt difficulty



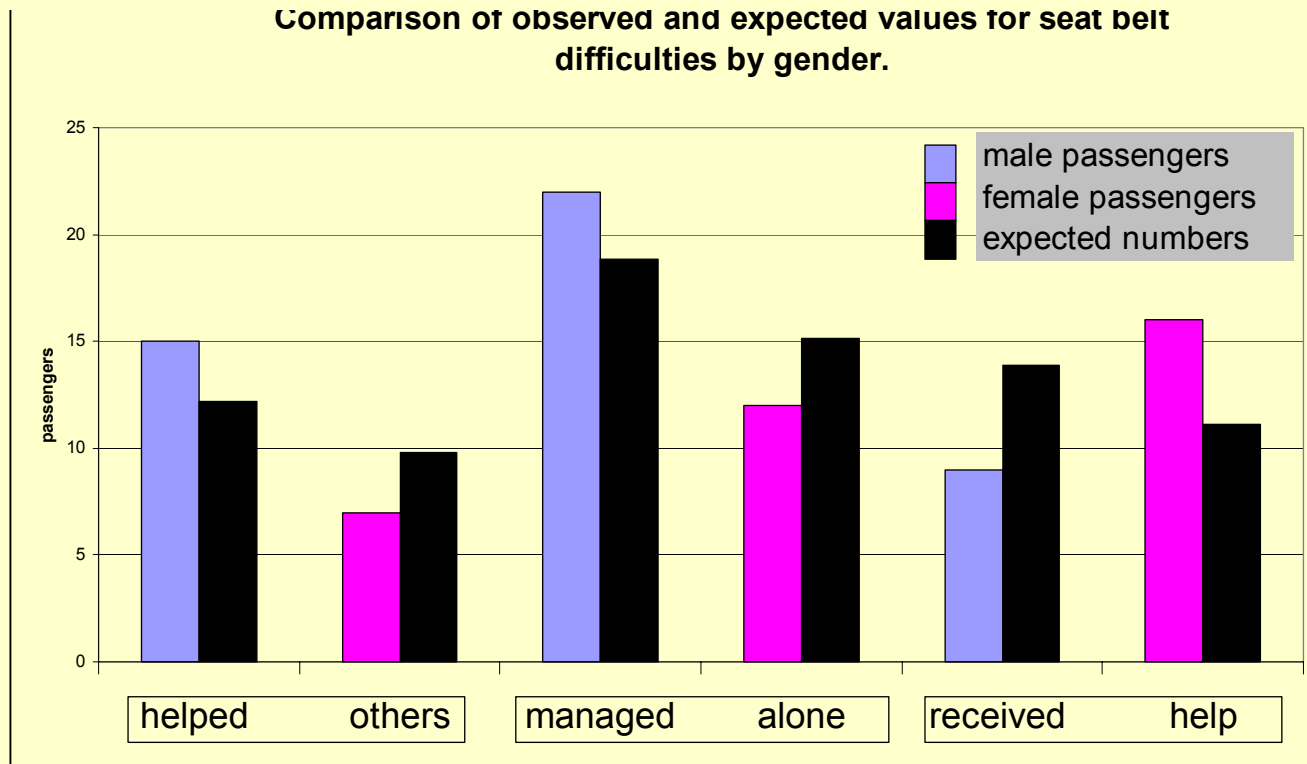
*•81 passengers reported problems  
With seatbelts.*

# AASK: Seatbelt difficulties

Age Distribution For All Passengers In AASK And For Those Involved With A Seatbelt Difficulty



# AASK: Seatbelt difficulty



- Chi square used to test m/f against required no help/required help.
- Significant at 5% level.



# AASK: Seat climbing

- 40 PAX cited that they climbed over seats, 20 were females.
- Mean age of climbing PAX is 27.4 years (c/w 39.4 years)
- This suggests that younger passengers may have a greater tendency to climb over seats.
- Mean age of male climbers is 32.5 years.
- Mean age of female climbers is 22.7 years.
- Only very young females are prepared or able to tackle this task?
- *Data on seat climbing often not reported as investigators do not ask the question and interviewees often do not think it is important!*





## AASK: Seat climbing

- Following quote suggests that others had gone over seats:

*“I went to the end of my row of seats and waited to get into the aisle, the aircraft stopped about this time.....I couldn't get into the aisle [because of the crowds] so I decided to go over the seats, the middle was flat and down, so I climbed over them and made my way to the front....”*

- Why do people climb over seats:

*“I was forced to jump on empty seats since the hall was blocked by passengers with children and disabled people.”*

*“The left escape slide did not inflate. I had to climb over seats in centre aisle to exit from the right”*

*“The doors at first did not pop then people forced them open. She climbed over the back of her seat and 'hopped' out”*



# AASK : Nearest Exit Usage

- Aviation industry had assumed paxs tended to use their boarding exit for evacuation - most familiar!
- AASK contains 619 paxs who reported exit usage and their starting location
- **440 paxs (71%) *did use their NEAREST EXIT***
- Of the 179 pax who did not use their nearest exits, 103 supplied reasons for their actions, these include:
  - \* 27: nearest exit was blocked
  - \* 22: followed FA instructions
  - \* 17: followed other passengers
  - \* 11: redirected due to congestion at their nearest exit
  - \* 9: choice made before egress
  - \* 7: thought the exit they used *was* their nearest exit
- **Data suggests 88% of paxs used or had a rational reason not to use their nearest exit.**



# AASK : Distance and Direction travelled

- Mean distance travelled by survivors is **6.3** seat rows.
- PAX who select their nearest exit – excluding those in exit rows - travel **3.8** seat rows regardless if they travel forward or aft.
- PAX who do not use their nearest exit travel **11.9** seat rows.
- **63%** of PAX went forward, **31%** went aft (others in exit row). Does this mean PAX prefer to travel forward?
  - **NO!**
  - Of PAX that move forward, **70%** select their nearest exit.
  - Of PAX that move to the rear, **69%** select their nearest exit.
  - Results suggest that the overriding ambition is to use their nearest exit, regardless of where it is!



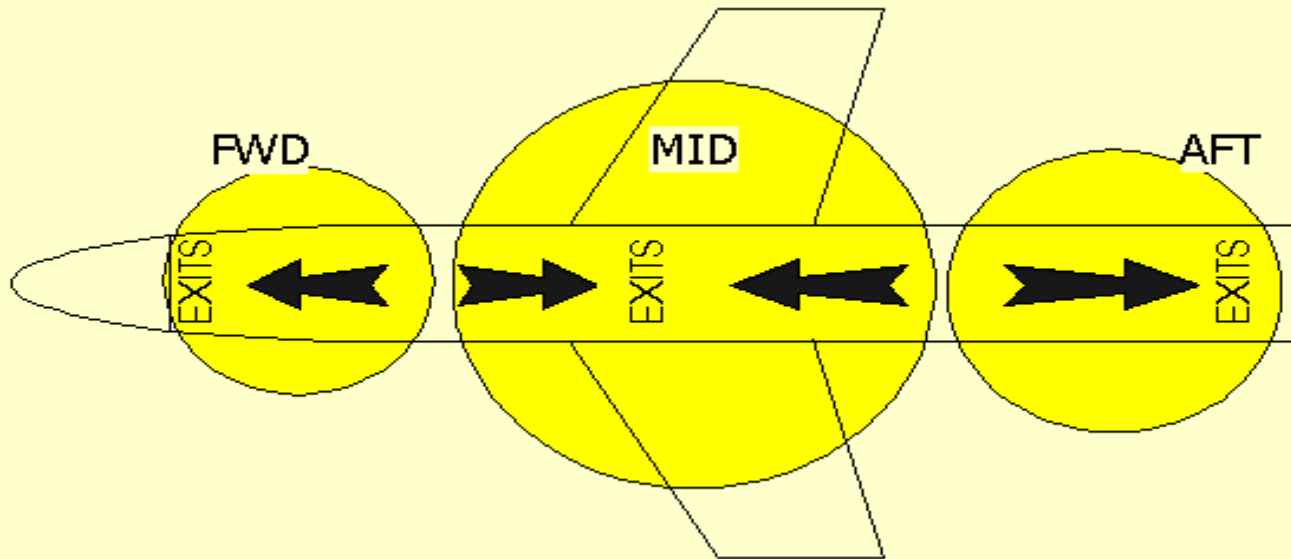
# AASK : Nearest Exit Usage

- Compare accident rate of nearest exit usage with that found in trials.
- 18 certification trials examined (12 wide-, 6 narrow-body).
- **In trials 76% of passengers use their nearest exit compared with 88% in accidents.**
- Very different results compared to accident analysis.
- Accidents appear very different to certification scenario
- However, many CC procedures based upon certification trials!



# AASK: Exit Usage

- Exit Distribution Analysis
  - AASK considers exits to be in five generalised positions, FWD, MID, AFT, MID-FWD, and MID-AFT



- Expected exit usage for a three-exit pair aircraft

# AASK V3.0 : Three pair Exit Use

- Exit Use from 3 aircraft with 3 exit pairs, type of exit in brackets

Aircraft	Pax Loading	Fwd (%)	Mid (%)	Aft (%)
1	93.6%	19.2 [I]	61.5 [III]	19.2 [I]
2	96.6	39.5 [I]	37.2 [III]	23.3 [I]
3	39.0%	44.7 [I]	50.0 [III]	5.3 [I]
<b>Mean</b>	-	<b>34.5</b>	<b>49.6</b>	<b>15.9</b>

- Exit Use from 2 aircraft with 3 exit pairs in certification tests

Aircraft	Fwd %	Mid %	Aft %
1	40	20	40
2	27	37	36
<b>Mean (%)</b>	<b>33.5</b>	<b>28.5</b>	<b>38</b>



# AASK V3.0 : Exit Availability

- Consider accidents in which aircraft is intact and not in water.
- 17 suitable accidents in database, 5 involving aircraft with 3 exit pairs and 12 with 4 exit pairs.
- For aircraft with 3 exit pairs:
  - 1 aircraft had 50% exit availability 1 with less.
- For aircraft with 4 exit pairs:
  - 2 aircraft had 50% exit availability 2 with less.
- Thus 35% of the aircraft had 50% or less exits available.
- 10 aircraft or 59% had a cabin section with no exit availability.
- No aircraft had a single exit available from each exit pair.



## Concluding Comments

- AASK provides a means of collating and analysing human behaviour data resulting from aircraft accidents.
- Information of this type is essential to improve our understanding of *ACTUAL* human dynamics involved in accidents.
- This understanding and information can be used to:
  - assist in the design of safer aircraft,
  - set more meaningful certification procedures,
  - and in the design of more realistic aircraft evacuation computer models.





## Further Work

- Work on AASK is continuing with further CAA Support, this includes:
  - Inclusion of additional accident data supplied by NTSB
  - Improving the user interface
  - Undertaking a wider analysis of the data e.g. role of the crew during evacuation, interaction of family groups, etc.
  - Widening the use of AASK to interested third parties via the internet
- Access to AASK can be obtained from the following site: <http://fseg.gre.ac.uk/aask/index.html>



# AASK V3.0 : Example Accident

Accident Selection:

Accident Date:  Flight No:  INDEX:

Accident location:  \* Accident Time:  (leave blank if unknown)

Aircraft Type:  \* Aircraft Manufacturer:  \*

Aircraft Operator:  \* Flight Type:

Flight Destination:  Category:

Acc Flight Position:  Hull Position:

Aircraft Orientation:  Orientation Angle:

Investigation Authority:  \* Report Date:  (leave blank if unknown)

Report Author:  \* Accident Designation:

Max Passenger Load:

**Injury Table**

Accident Summary:

THE AIRCRAFT CAME TO REST FORWARD AND RIGHT OF END OF RUNWAY DURING LANDING. RESTING ATTITUDE MOSTLY LISTING TO PORT AND SLIGHTLY TO NOSE . 189 PAX, 3 FC & 10 FAs. EVACUATED. RAIN & THUNDERSTORMS AT TIME OF LANDING. LIGHTNING DAMAGE TO RIGHT WING TIP

	FC	FA	PAX	Oth	Total
<b>Fatal</b>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>Serious</b>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="2"/>	<input type="text" value="0"/>	<input type="text" value="2"/>
<b>Minor</b>	<input type="text" value="1"/>	<input type="text" value="2"/>	<input type="text" value="35"/>	<input type="text" value="0"/>	<input type="text" value="38"/>
<b>None</b>	<input type="text" value="2"/>	<input type="text" value="8"/>	<input type="text" value="152"/>	<input type="text" value="0"/>	<input type="text" value="162"/>
<b>Total</b>	<input type="text" value="3"/>	<input type="text" value="10"/>	<input type="text" value="189"/>	<input type="text" value="0"/>	<input type="text" value="202"/>

Record:      of 55



# AASK V3.0 : Example Passenger

**PASSENGER-INPUT : Form**

Exit Flow	Assistance	Egress Desc	Smoke/Fire Desc	Fire Effects	Transcript	Finish			
Basic Info	Leave Seat	Evac Route	Exit Info	Companions	Inaction	Att Behav	Obstructions	Injuries	Queues

### BASIC PASSENGER INFO

Passenger No:  Accident:

Data Source:

Gender:  Age:  0=infant (<2yrs)  
999=unknown

Weight (kg):  Or (lb):

Height (cm):  Or (inches):  0=unknown

Seat Row:  Seat Label:  Assumed Seat:

Disabilities:

Flight Experience:

Pre-flight Briefing:

Occupation:

Basic Info Notes:

Record:  of 36



# AASK V3.0 : Example Cabin Crew

**CabinCrew\_Input : Form**

Personal Details | Training | Pre Flight Details | Response | Seat Leaving | Exit Information | Performance Info | Notes

74 Cabin Crew Number: 1 Accident ID: 45

Data Source: SUMMARY Gender: MALE Height (cm): 0 OR (inches): (0=unknown)  
Age: 37 (999=unknown) Weight (Kg): 0 OR (lb):

Rank: CABIN CREW Nationality: N/D (N/D = unknown) Nationality Same As Carrier

---

AirLine	Date Of Hire	Duration	Personal Notes:
Current Service AMERICAN AIRLINES	December 23, 1976	102	
Previous Service		0	
Extra Months of Service: 0	Total Months of Service: 102		

---

Seat Location: SEAT BY EXIT Seat Type: JUMP  
Nearest Seat Row: 1 Nearest Seat Label: A

Seat Notes:  
OUTBOARD SIDE OF THE AFT FACING JUMP SEAT, FORWARD OF THE FL EXIT

---

Role: DOOR ASSIGNED ATTENDANT Region of Responsibility: FORWARD  
Primary Assigned Exit: FORWARD LEFT Secondary Assigned Exit: FORWARD RIGHT

Record: 1 of 10



# AASK V3.0 : Example Fatalities

**Update Fatalities** [X]

Fatality ID:  Accident:

Fatality Number:

Fatality Type:  Gender:  Age:  0=infant (<2)  
999=unknown

Height (cm):  OR (inches):  0=unknown

Weight (kg):  OR (lb):

Seat Row:  Seat Label:  (Enter 999 Z if Unknown)

(Enter Absolute Values, 0=unknown)

Body Location:  Abs Row of Body:  Abs Column of Body:

(Enter Values between 0 and 100 if Known Or 999 If Unknown Level)

CO (%):  HCN (ppm):  CO2 (%):

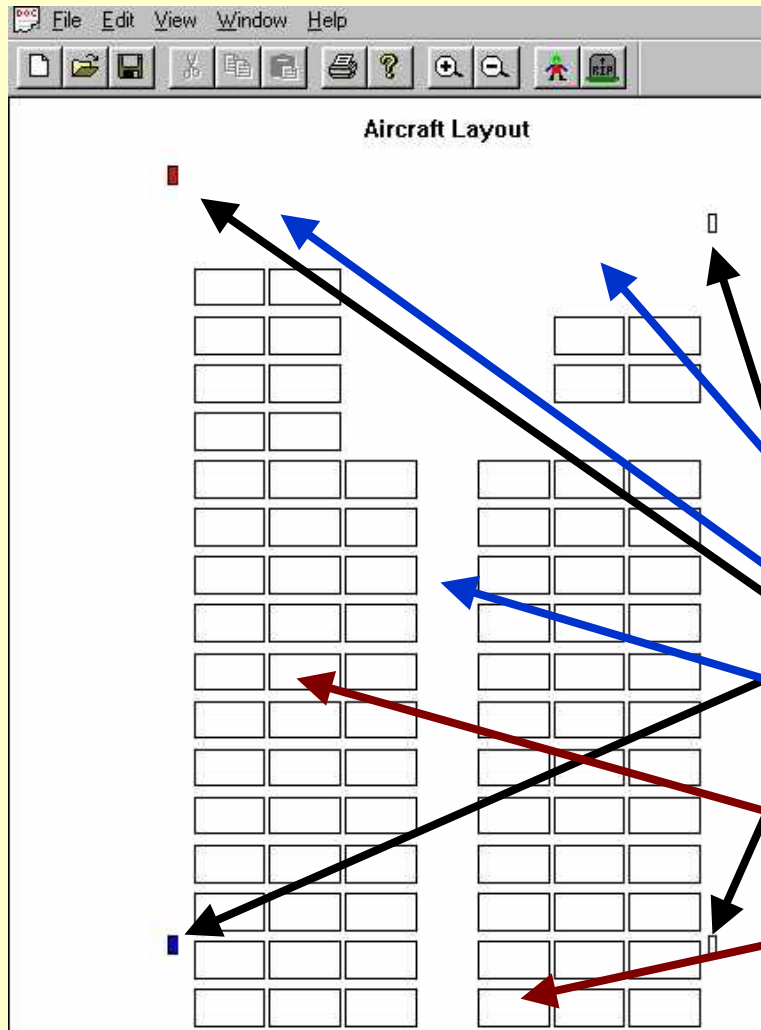
Cause Of Death:  Details:

Notes:

Record:      of 110



# AASK V3.0 : Seat Plan Viewer



**Empty seat plan  
Passenger and Fatality  
buttons off**

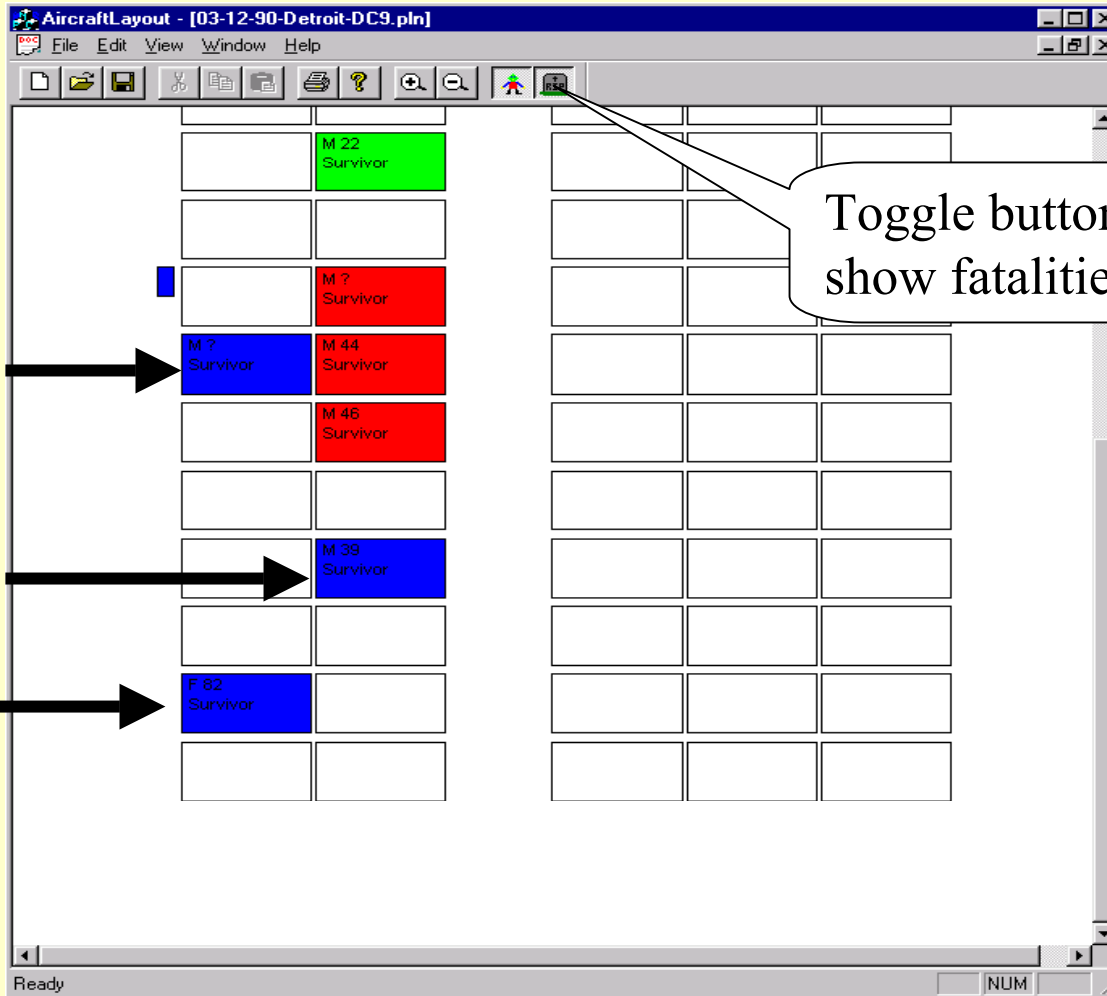
**EXIT LOCATIONS**

**AISLES**

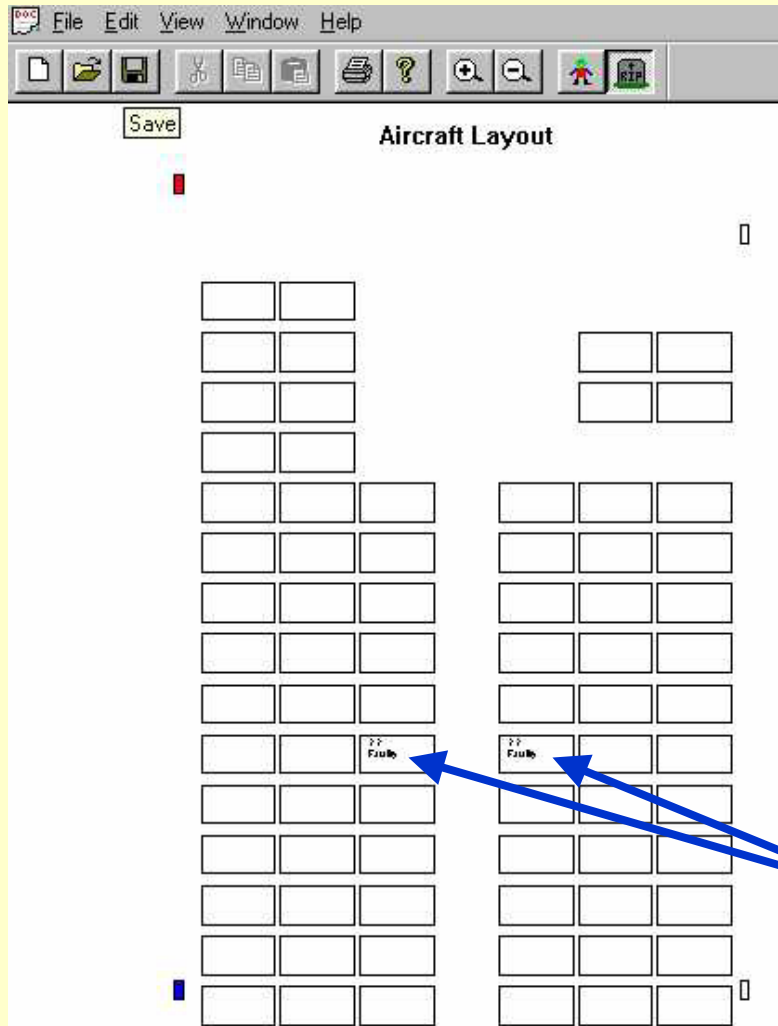
**SEATS**



# AASK V3.0 : Seat Plan Viewer



# AASK V3.0 : Seat Plan Viewer



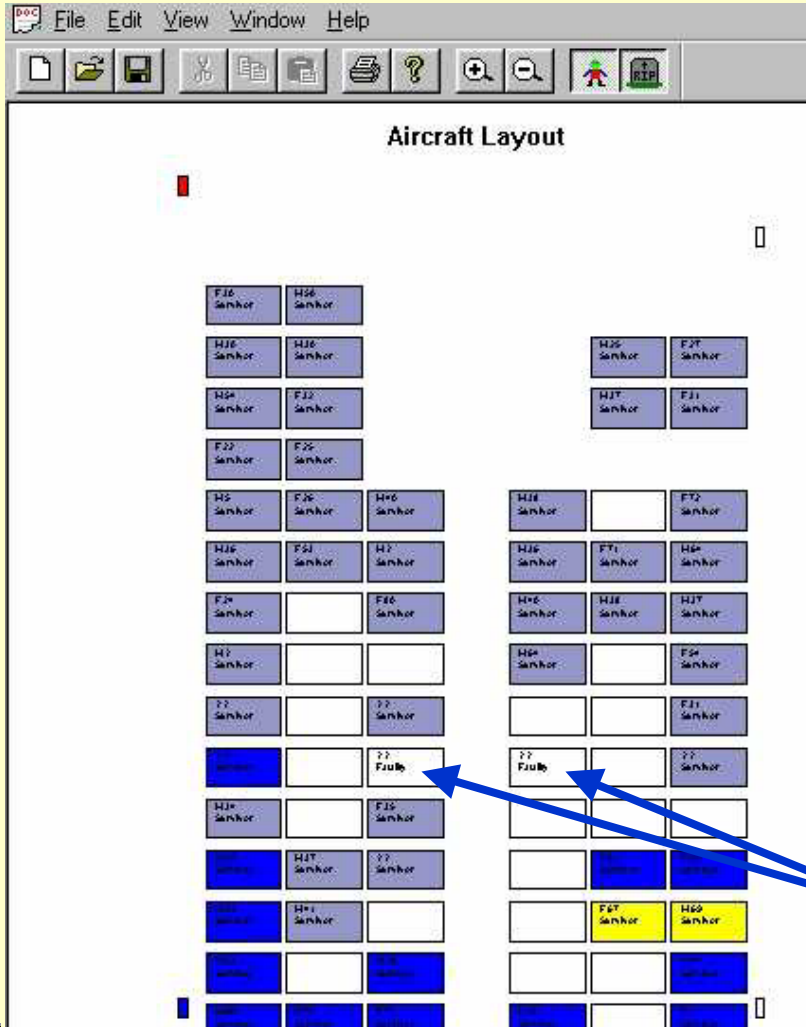
**Fatality button on  
Passenger button off**

**Two Fatalities Located  
Here.**



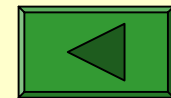


# AASK V3.0 : Seat Plan Viewer



**Passenger and Fatality  
buttons on**

**Two Fatalities Located  
Here.**



# AASK User Interface/Query Data

- Access to AASK is via one of three routes:
  - locally on a host computer,
  - over a local user intranet, and
  - over the internet.
- The Query Engine developed as part of this project provides access over all three routes.
- Most users will access AASK via the internet.
- User-manual also provided on-line.



# AASK V3.0 : Internet Facility

- **Availability**
  - Internet access is all that is required
  - No DBMS necessary
- **Consistency**
  - Data maintained and protected in central location
  - Changes to data, interface or database once made, available to all
  - Version Control
- **Security**
  - Only authorised users have access to the site
  - Machine and software protection possible by central control
  - Passwords and multi-level security maintained
- **Location**
  - site <http://fseg.gre.ac.uk/aask/index.html>



# AASK V3.0 : User Interface (v1)

The screenshot shows the 'Main Screen' of the AASK V3.0 User Interface. The interface includes a directory of database tables and fields on the left, a central area for field selection and query execution, and a bottom section for adding conditions and sorting. Callout boxes provide detailed explanations for various UI elements.

**Directory structure of the database tables and fields**

- Accident\_Table
- Cabin\_Descriptions
- CabinCrew\_Performance
- CabinCrew\_Table
- Exit\_Information
- Fatality\_Table
- MM\_CabinCrew\_Assistance
- MM\_CabinCrew\_Briefing
- MM\_CabinCrew\_Commands
- MM\_CabinCrew\_Evaluation

**Chosen fields appear here**

**Button to launch the query**

**Moves to 'setting criteria' screen**

**Button returns to log in screen**

**Display for each field chosen giving data details**

**Button to add a field**

**Deleting buttons for field(s)**

**Moves to the sorting screen**

**SQL code for query**

Field Name	Data type	Size	Description
------------	-----------	------	-------------

Buttons: Add Field, Remove Field, Remove All Fields, Execute Query, Add condition to the query, Sort query, Log out

Options: All, Distinct

Text: Selected fields, rows



# Access to ASK via the Internet Facility

◆ AASK interface makes use of applet and JDataServer to provide access via the internet.

