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 recommital*, *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

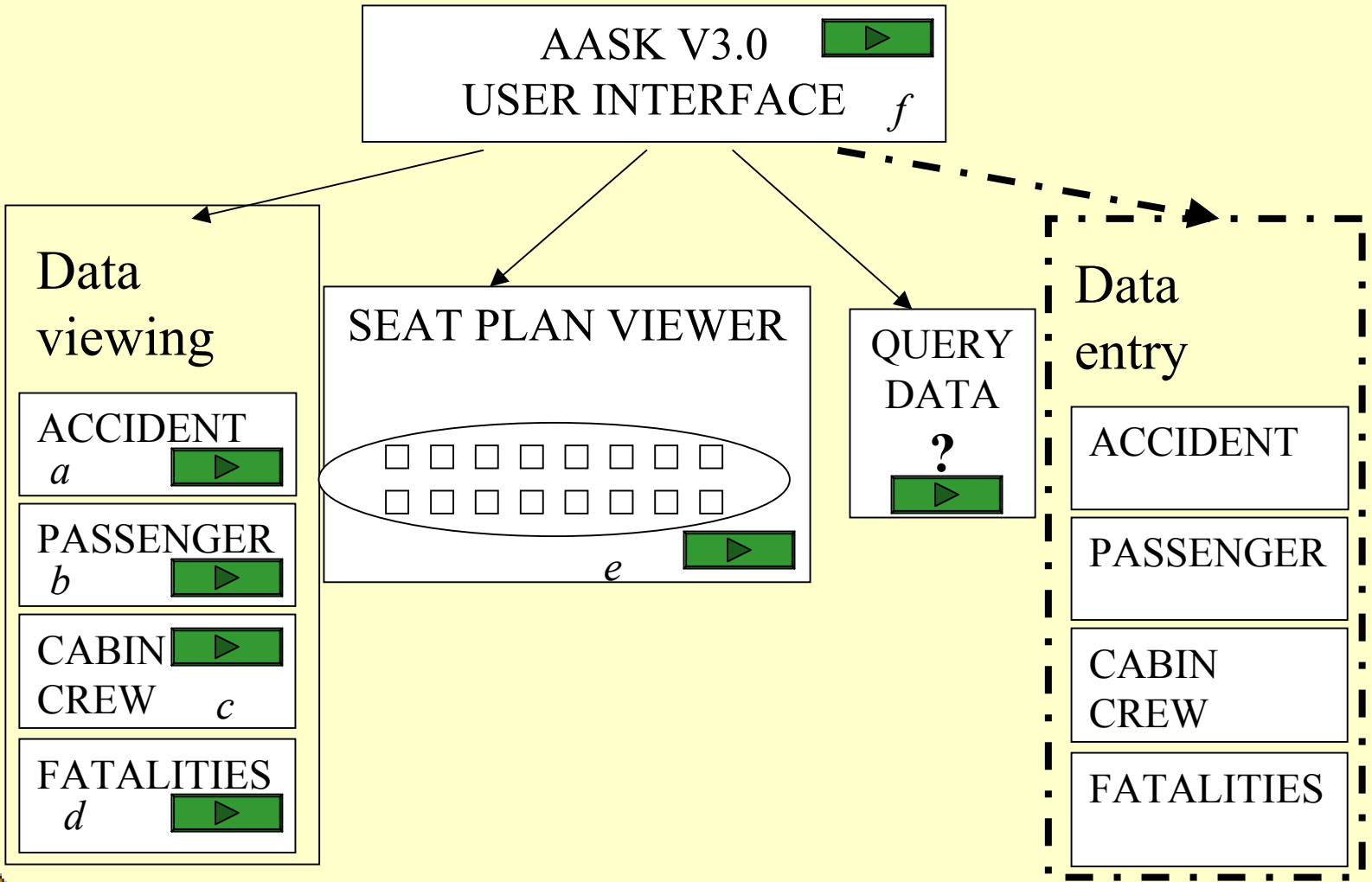
AASK V3.0 : Additional Data

- **Additional accident data included**

	AASK V2.0	AASK V3.0
Accidents	**25**	**55**
Pax accounts	**669**	**1295** (4855 survivors)
Crew accounts	**0**	**110**
Fatalities	**0**	**327** (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

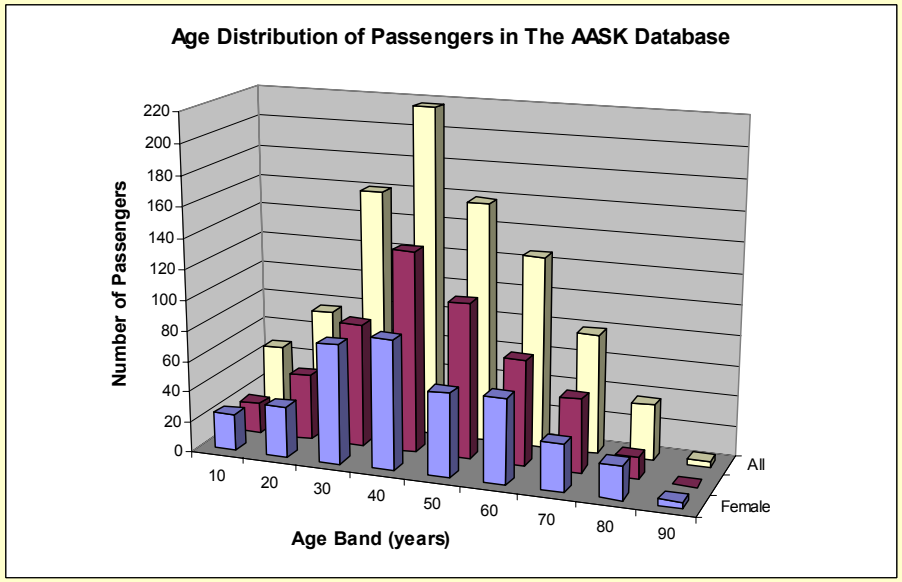
- **Basic Survivor/Reply Rate Analysis**

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

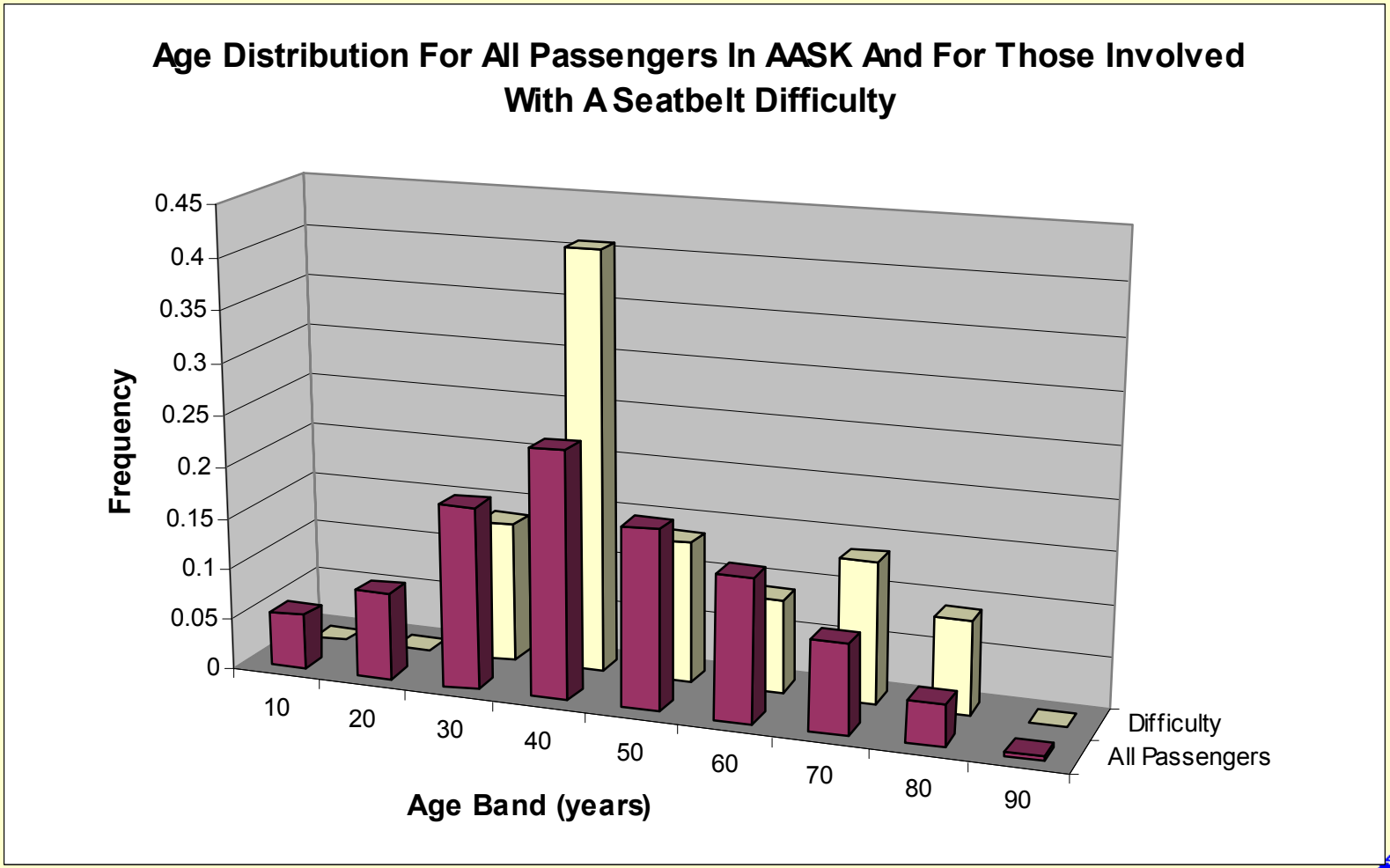


  - Mean age of all survivors = 39.4 years
  - Attributes may be cross categorised, e.g. by gender
  - Mean female survivor age = 39.3 years
  - Mean male survivor age = 39.8 years

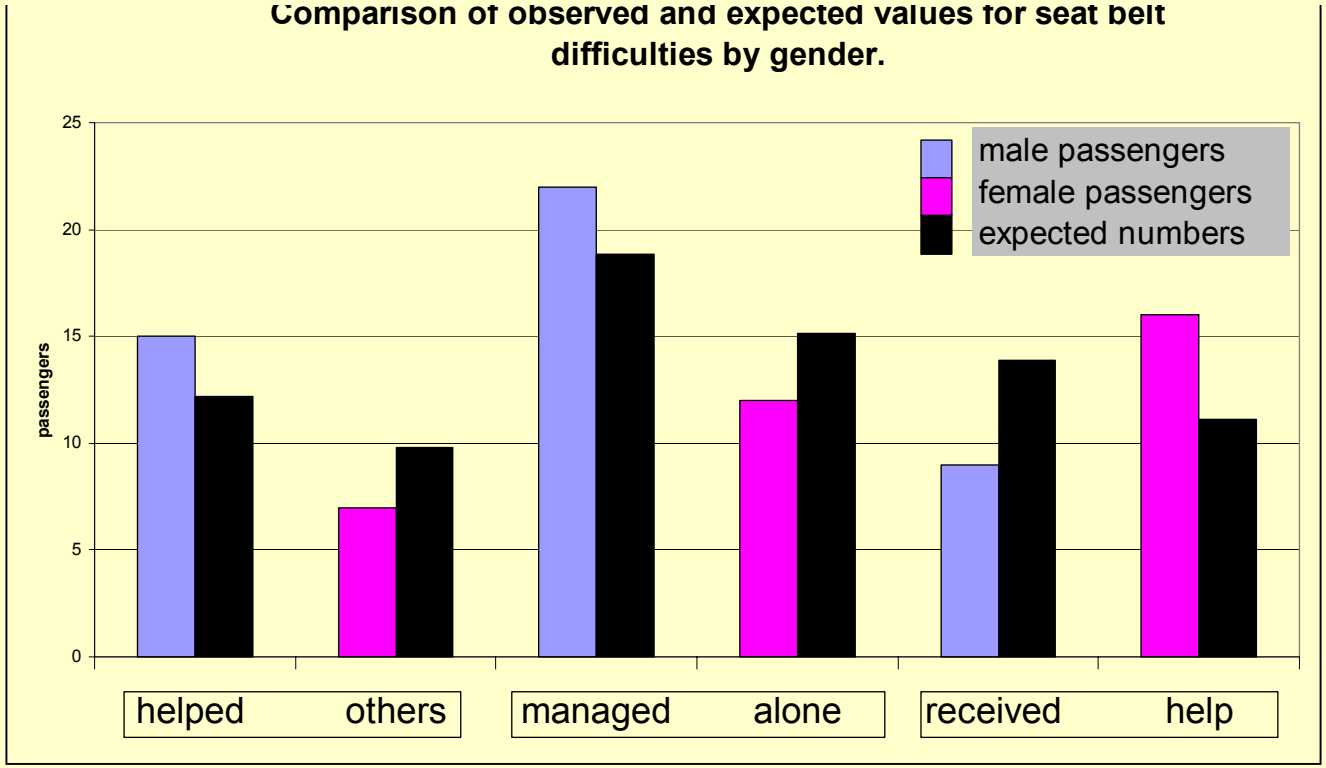
AASK: Seatbelt difficulty

- ***81 passengers reported problems With seatbelts.***

AASK: Seatbelt difficulties



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.

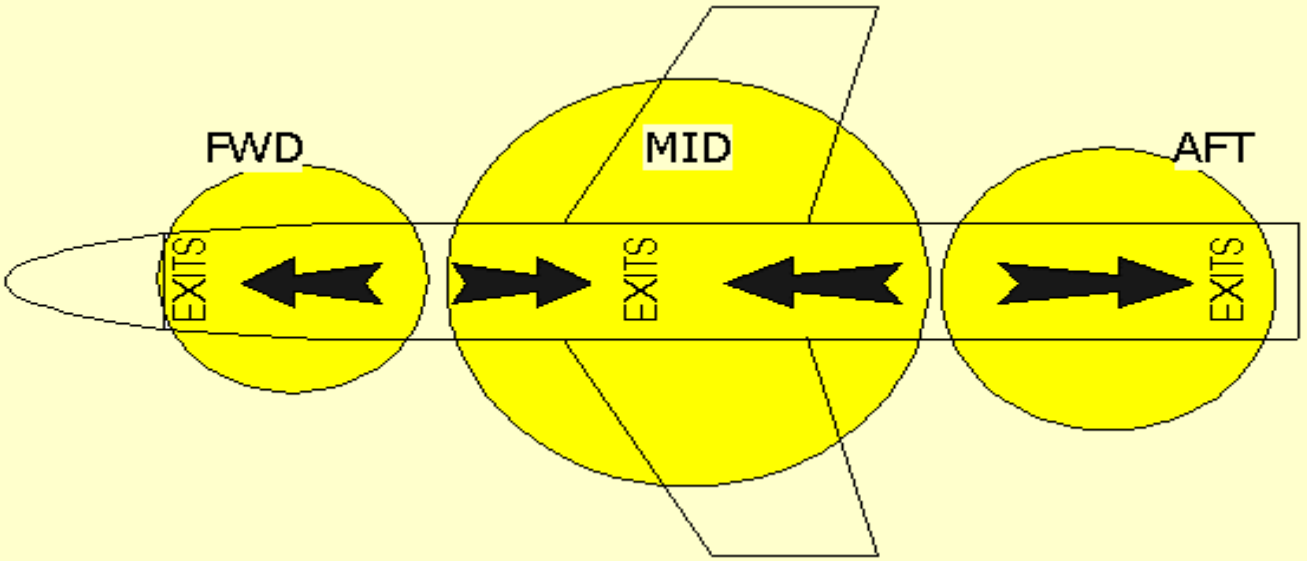
•Results suggest that the overriding ambition is to use their nearest exit, regardless of where it is!

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]
Mean	-	**34.5**	**49.6**	**15.9**

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

Aircraft	**Fwd %**	**Mid %**	**Aft %**
1	40	20	40
2	27	37	36
Mean (%)	**33.5**	**28.5**	**38**

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.

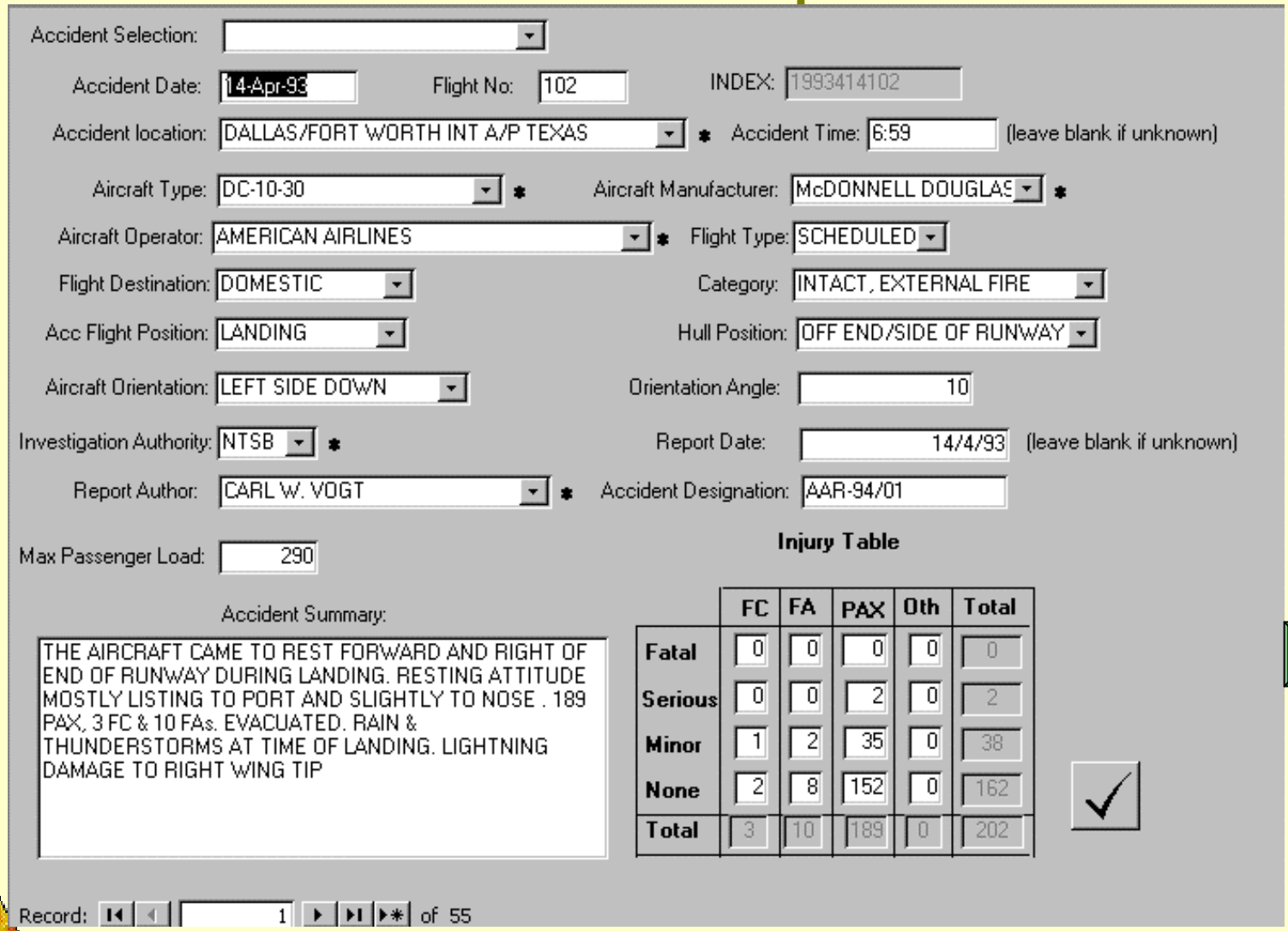
Concluding Comments

- 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.

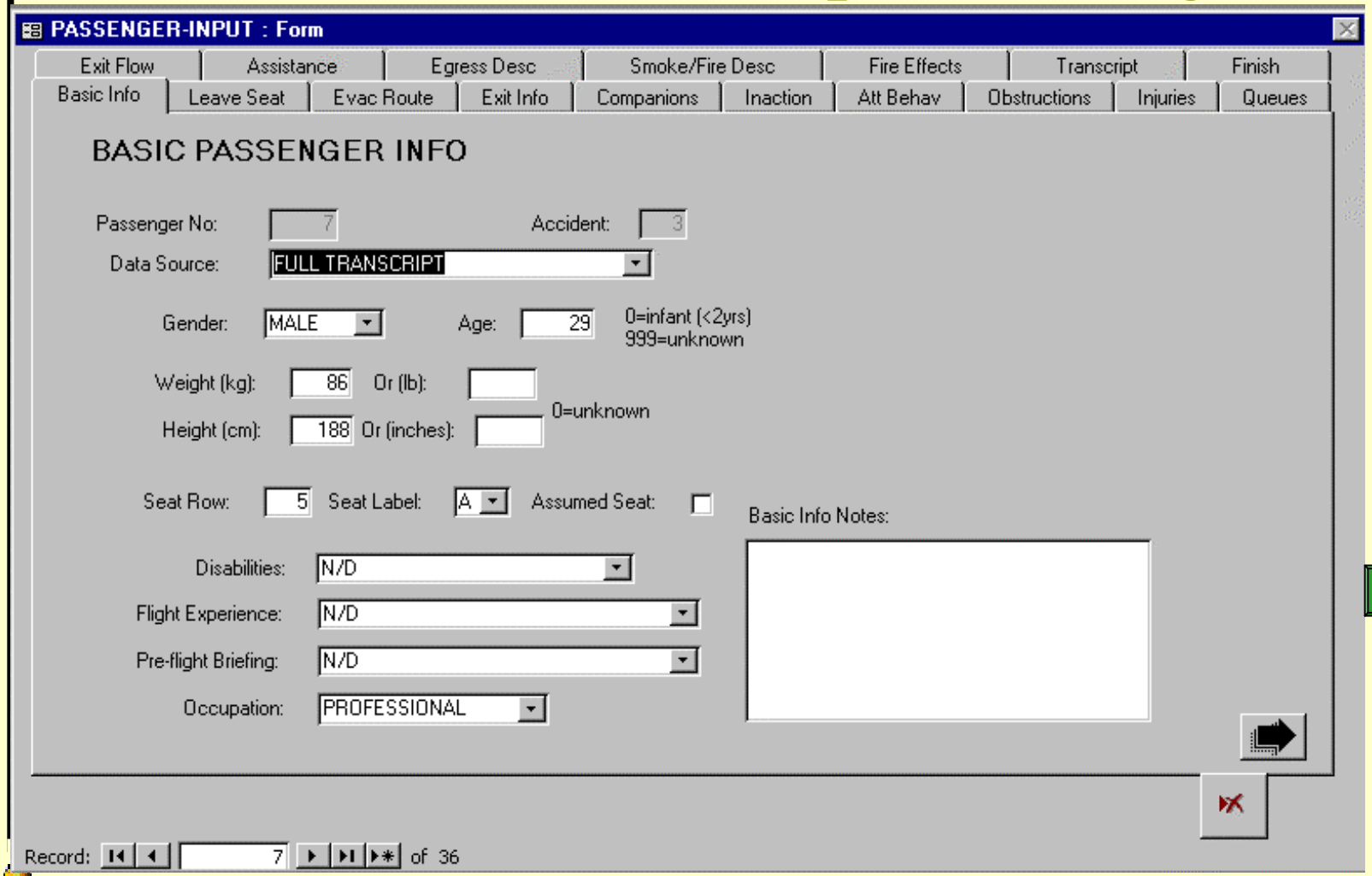
Further Work

- 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



AASK V3.0 : Example Passenger



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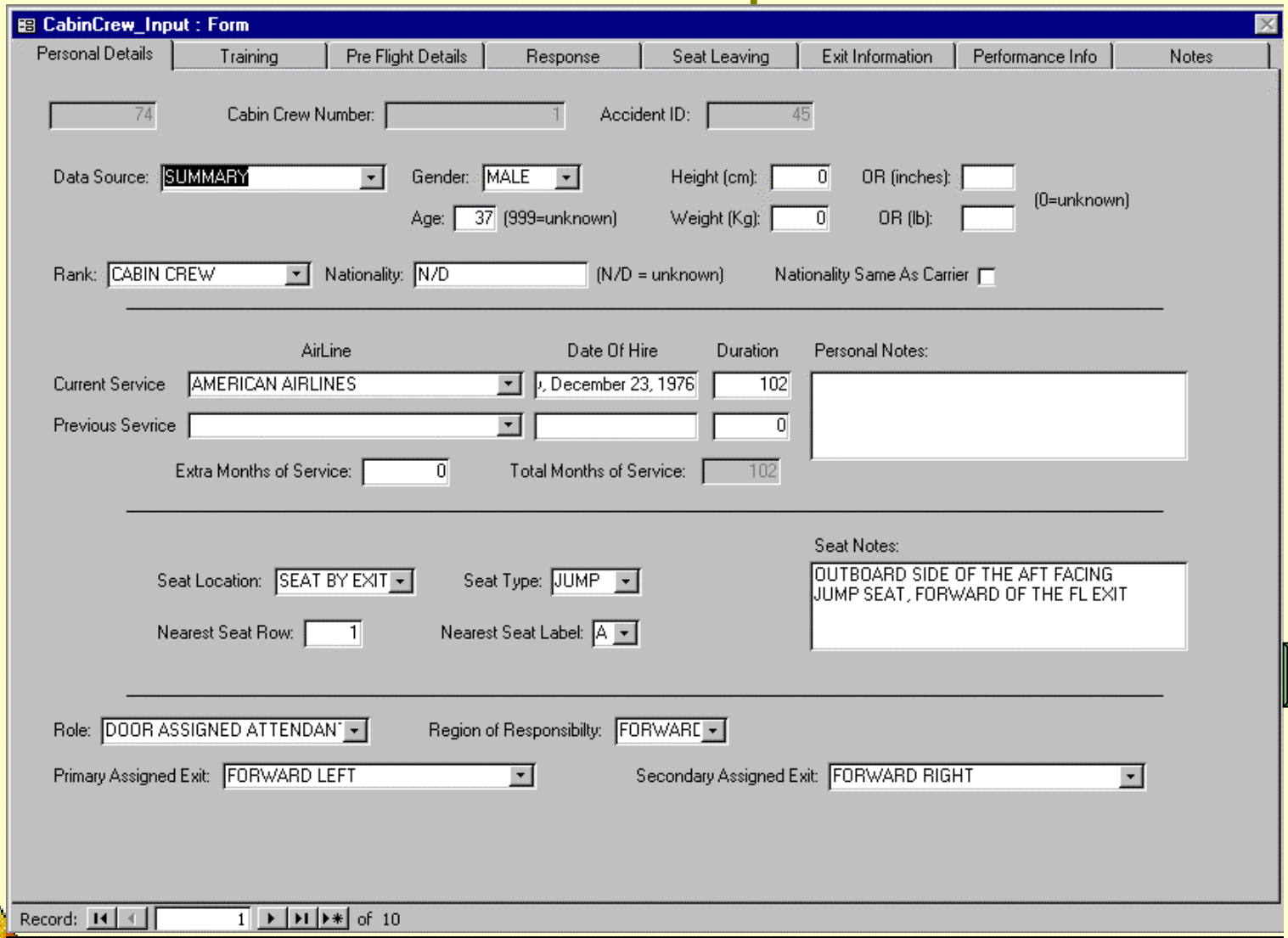
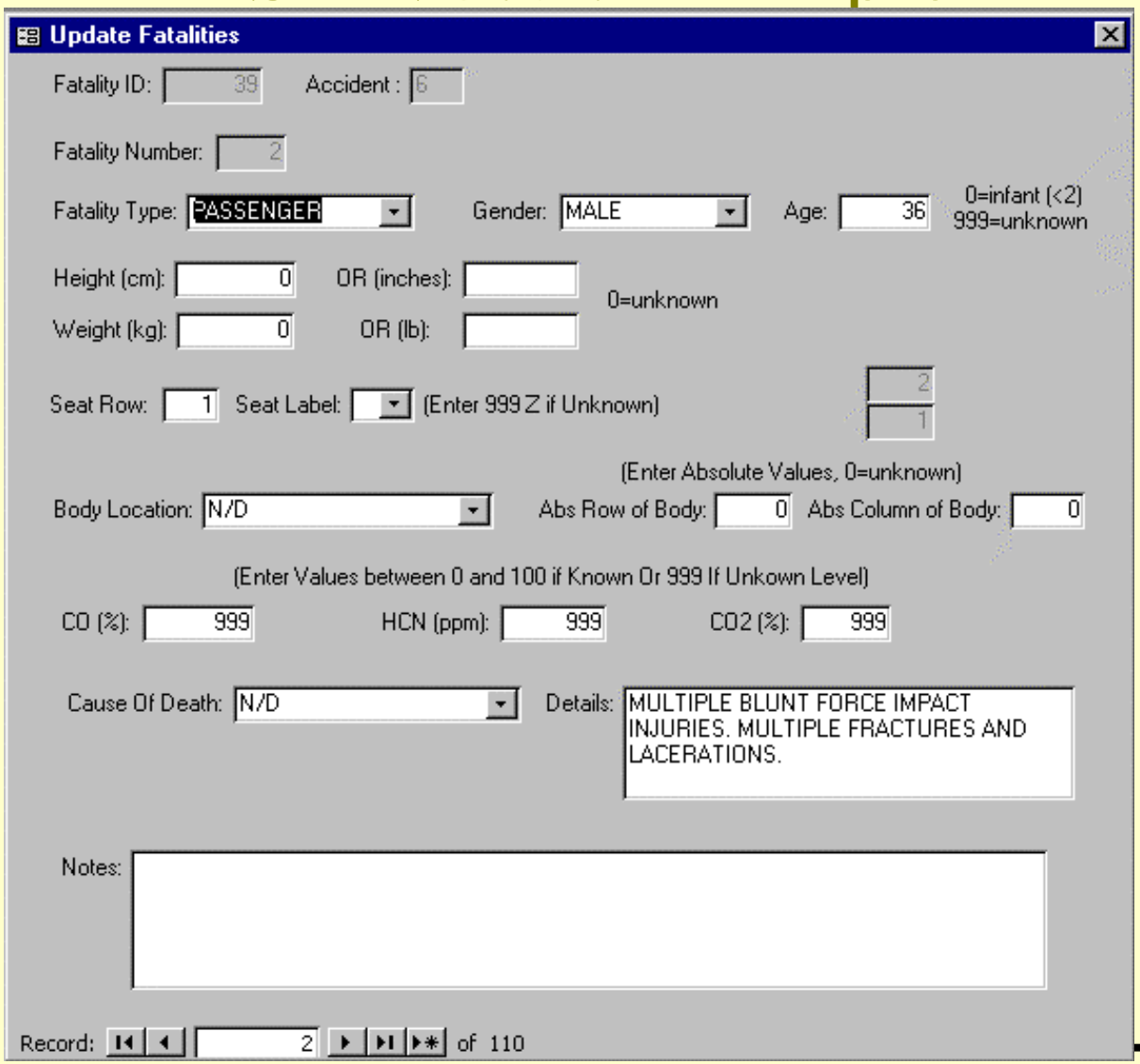
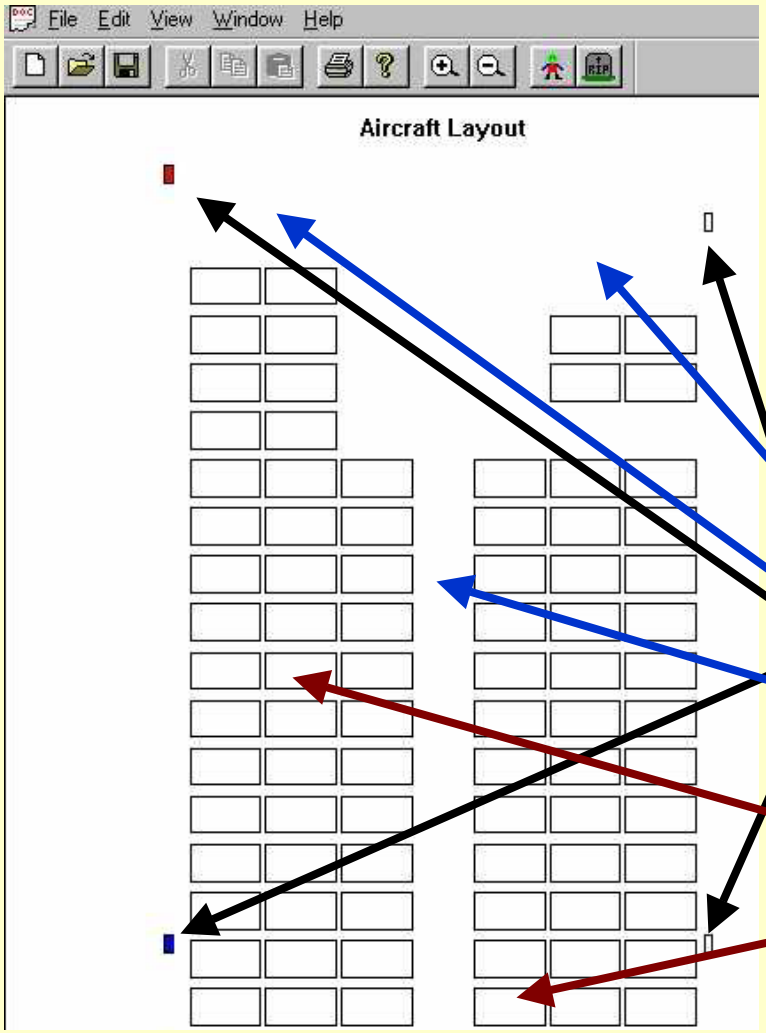
AASK V3.0 : Example Cabin Crew



AASK V3.0 : Example Fatalities



AASK V3.0 : Seat Plan Viewer



Empty seat plan

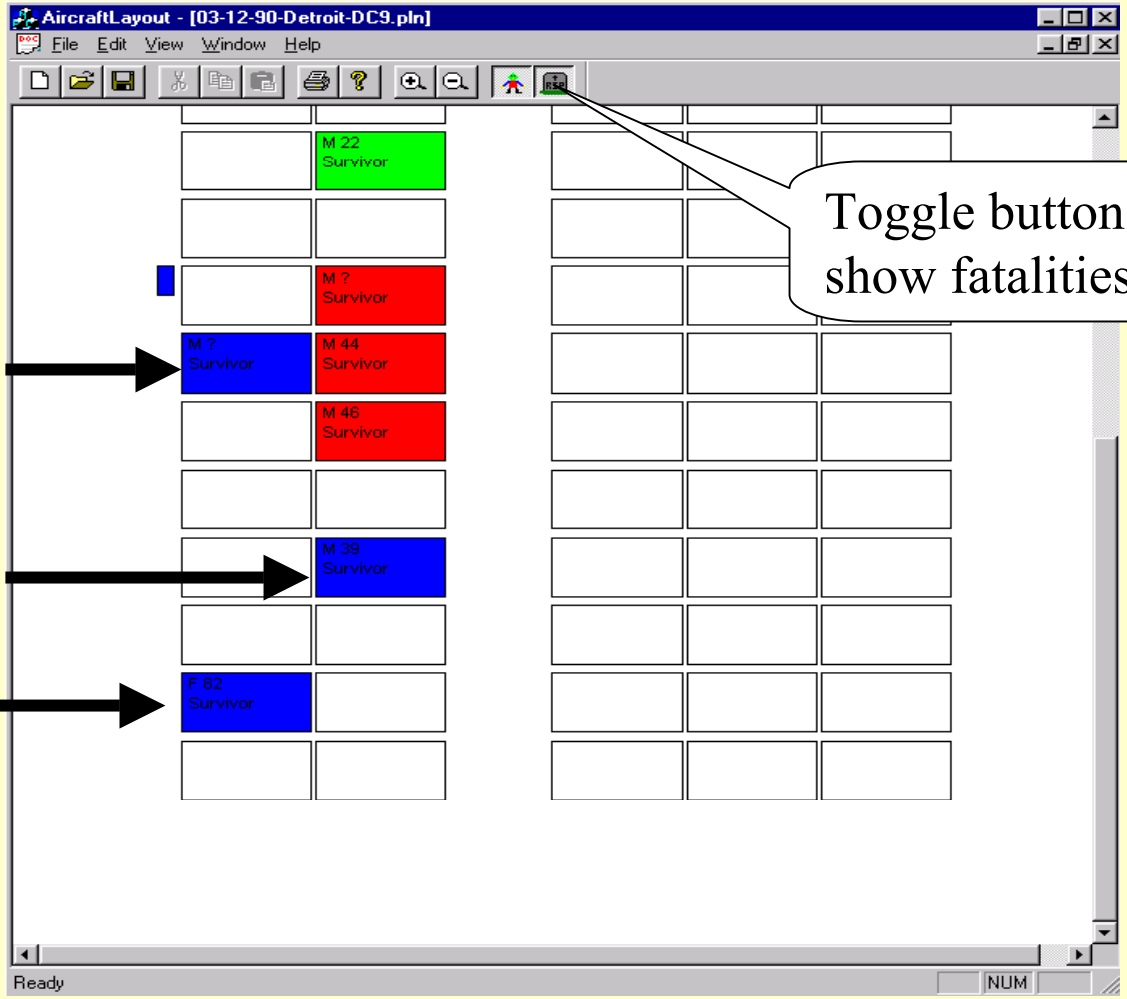
Passenger and Fatality buttons off

EXIT LOCATIONS

AISLES

SEATS

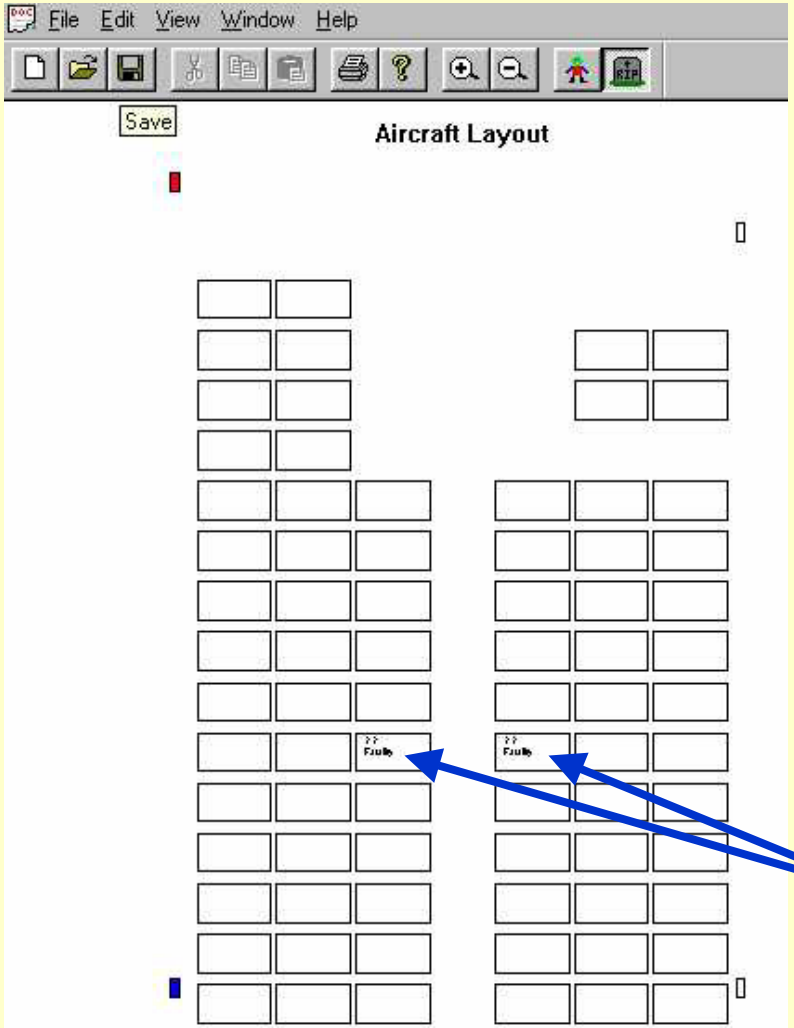
AASK V3.0 : Seat Plan Viewer



Toggle button to show fatalities

Three survivors who used the 'blue' exit

AASK V3.0 : Seat Plan Viewer

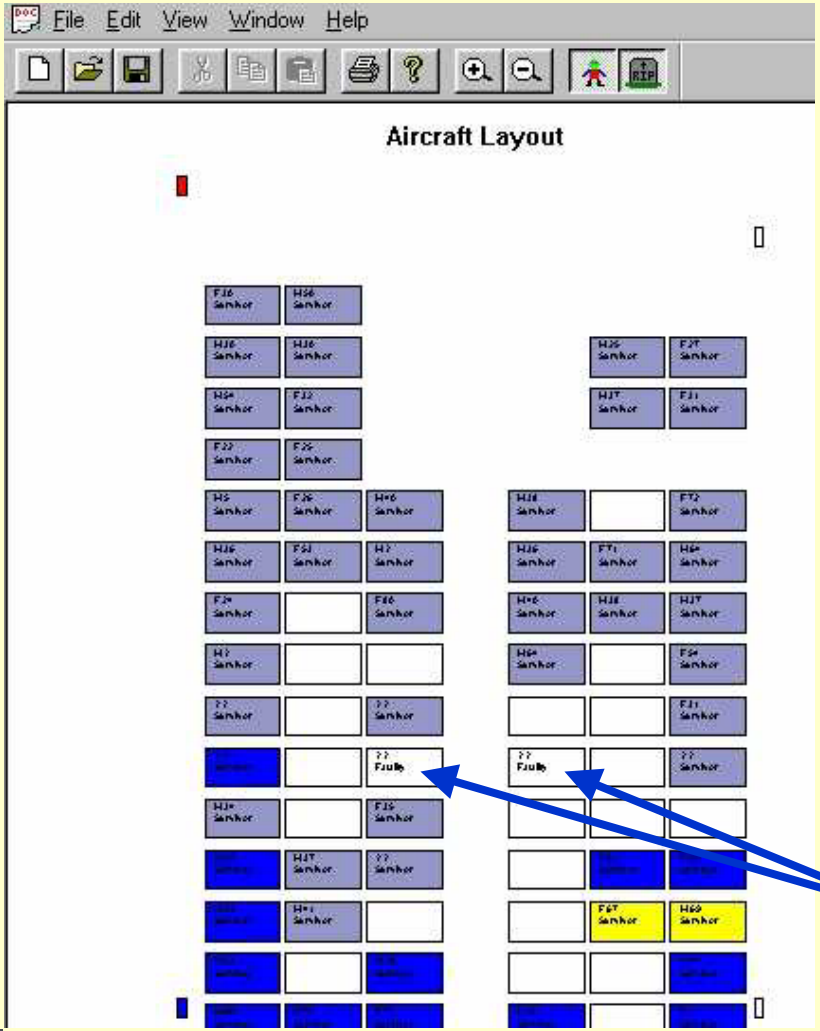


Fatality button on

Passenger button off

Two Fatalities Located Here.

AASK V3.0 : Seat Plan Viewer



Passenger and Fatality buttons on

Two Fatalities Located Here.

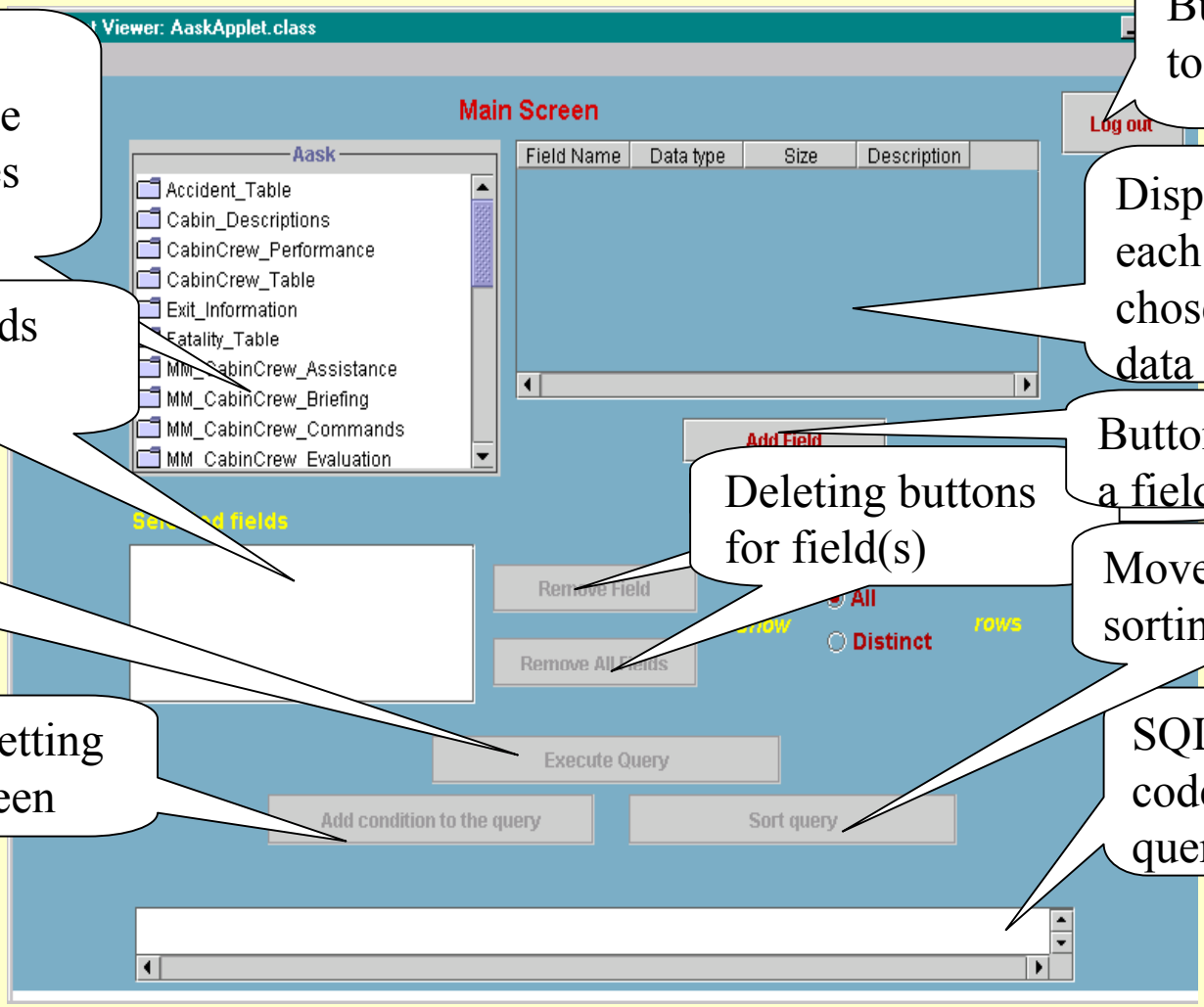
AASK User Interface/Query Data

- 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)



Directory structure of the database tables and fields

Button returns to log in screen

Chosen fields appear here

Display for each field chosen giving data details

Button to add a field

Deleting buttons for field(s)

Button to launch the query

Moves to the sorting screen

Moves to 'setting criteria' screen

SQL code for query

Access to ASK via the Internet Facility

♦AASK interface makes uses of applet and JDataServer to provide access via the internet.