The Aircraft Accident Statistics and Knowledge (AASK) database V4.0

By

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Contents

- Introduction

    - The Need For Data

- AASK Development

- AASK V4.0 Features

- AASK Example Analyses

- Conclusions

- Further Work

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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.

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
  - Project started in 1997 with support from UK CAA
  - Currently on V4.0.

  - **http://fseg.gre.ac.uk/aask/index.html**

AASK V4.0 : New features

- **Additional Accident data included**
  - Almost 2000 survivor accounts included

- **New Accident Categories added**
  - Emergency Evacuation
  - Unplanned Emergency
  - Precautionary Evacuation
  - Post Incident Deplaning.

- **Database Enhancements**
  - Structure and Security
  - On line help
  - Component Selection
  - Performance Improvements

- ## **Query Engine**
  - Query simplification and confirmation
  - Inclusion of pre-constructed queries
  - Cutting and pasting query results included
  - Support for aggregate functions
- ## **Seat Plan Viewer**
  - Availability of SPV via Web
  - Accident information displayed
  - Graphical output of seats and exits
  - Exists used by each passenger easily seen by colour coding
  - Viewing of either survivors or fatalities or both
  - Passenger information - information displayed for each passenger
  - information concerning travelling companions displayed
  - Exits used
  - Fatality seating and exit usage options

AASK V4.0 : Additional Data

- **Additional accident data included**

	AASK V2.0	AASK V3.0	AASK V4.0
Accidents	25	55	105
Pax accounts	669	1295	1917
Crew accounts	0	110	155
Fatalities	0	327	338

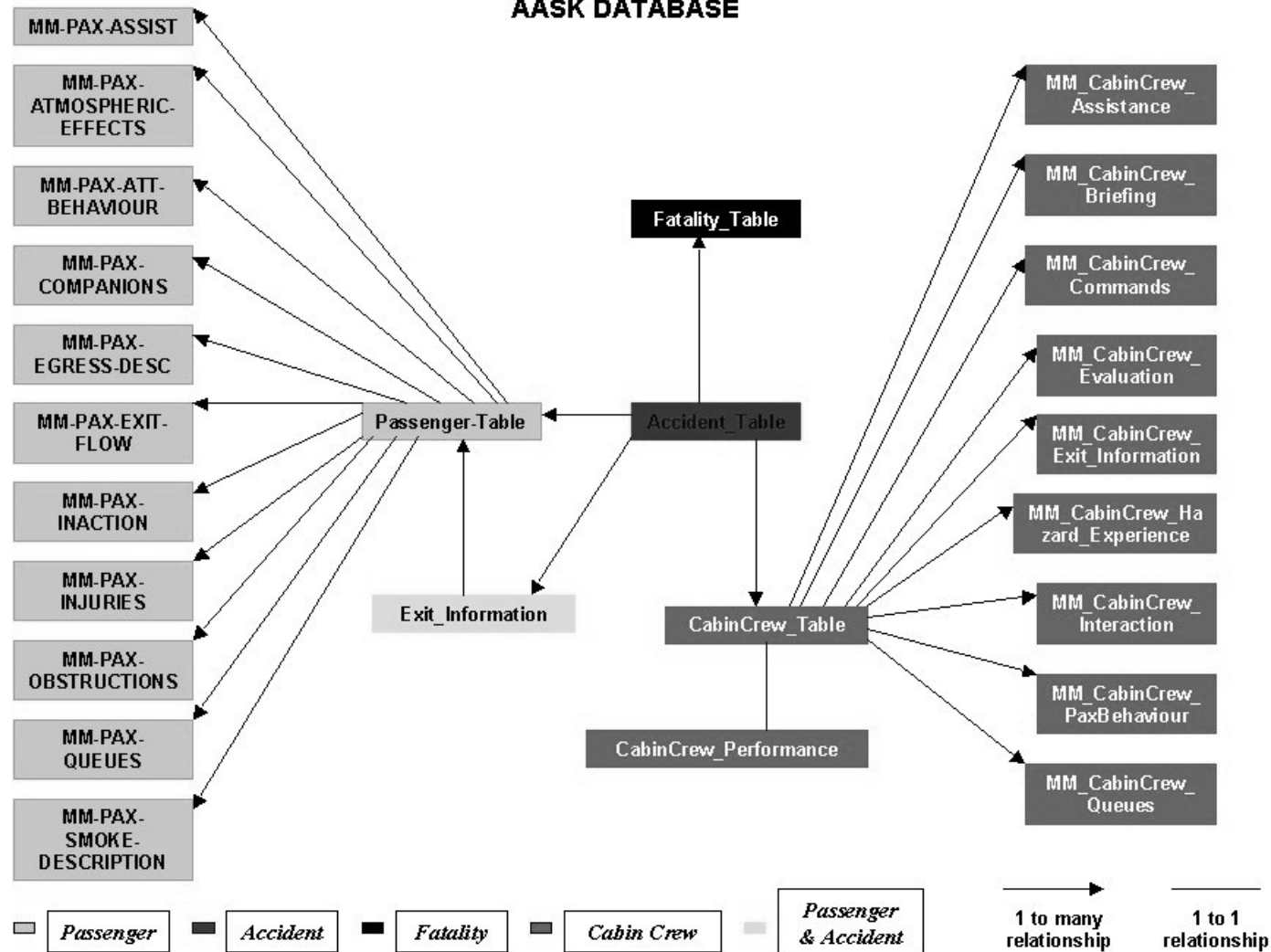– Data in AASK 4.0 covers the period from 04/04/77 to 23/09/99

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AASK V4.0 : Aircraft Accident Reports

- **Previous data re-entered**

  - Many additional fields included in AASK V4.0
  - Some categories now subdivided for greater detail and depth
  - Additional information concerning old accidents included

- **Data entry accuracy check**

  - Queries run as accuracy checks on data sets
  - Spot cross checking in the course of running reports

- **AASK V4.0 verified with previous data**

  - Flags put to identify data sources
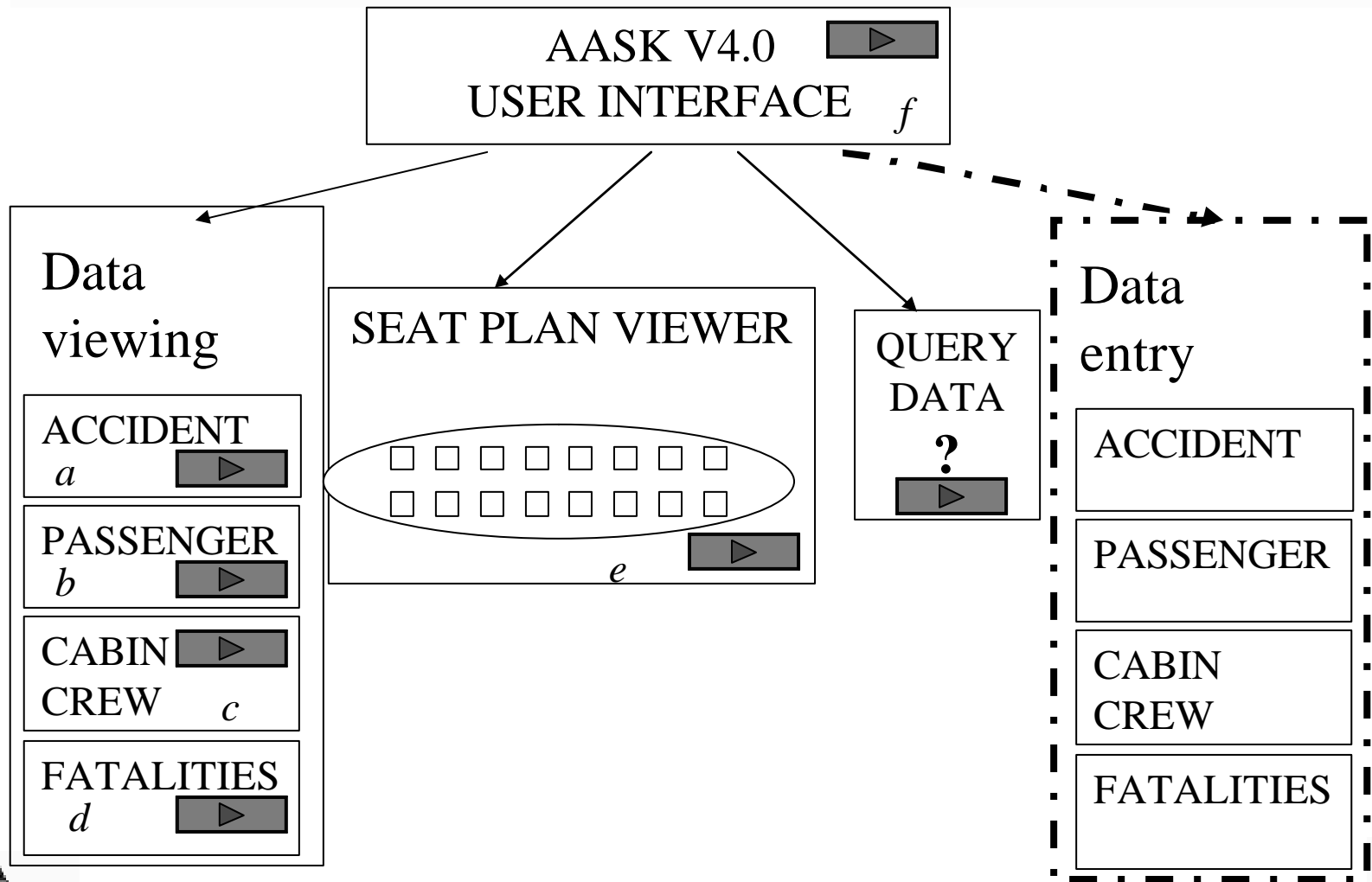 - Queries repeated from previous analysis & results compared

AASK V4.0 : Database Overview

AASK DATABASE
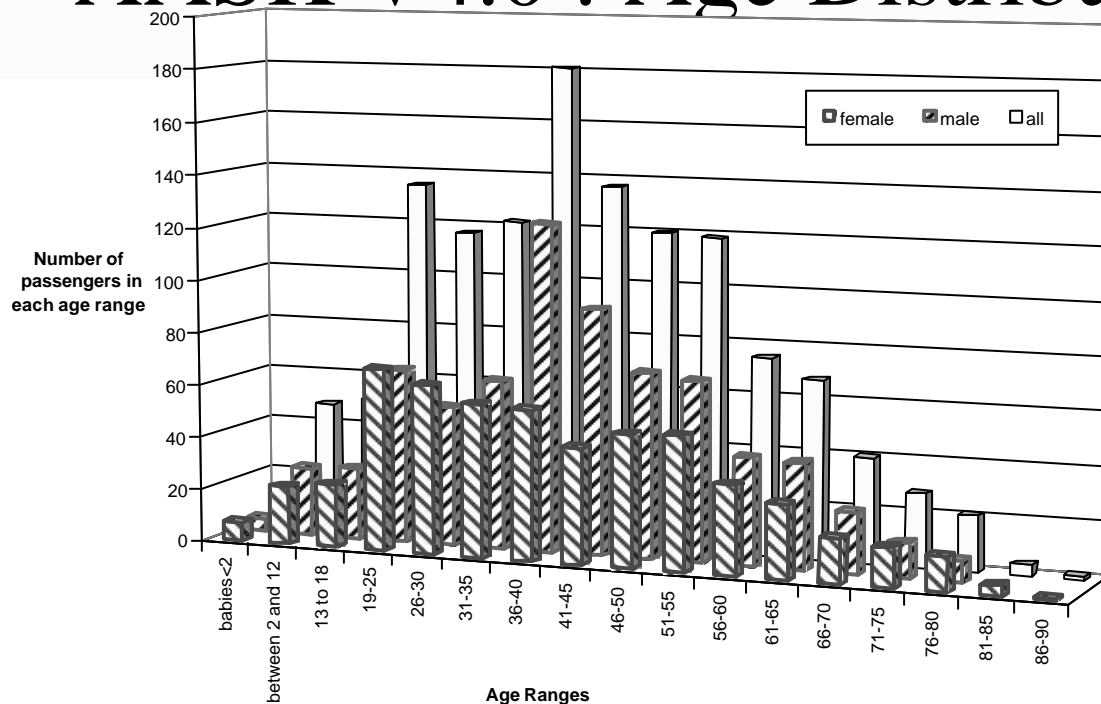
AASK V4.0 : Database Structure

AASK V4.0
USER INTERFACE *f*

Data viewing

ACCIDENT
a

PASSENGER
b

CABIN
CREW *c*

FATALITIES
d

SEAT PLAN VIEWER

e

QUERY
DATA
?

Data entry

ACCIDENT

PASSENGER

CABIN
CREW

FATALITIES

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AASK V4.0 : Age Distribution

- Age known for 69% of paxs in AASK
- Of these 56% male 44% female
- Average age of survivors 40 for both genders
- Markedly more male than female in ages 35-55
- Oldest surviving female 86, oldest male 80

AASK V4.0 : Travelling companions

- 947 (49.4%) paxs in AASK reported that they were **not** travelling alone

- Suggests social bonding could be a significant factor in evacuation dynamics – **yet no studies to date!**

- Mean group size was 2.4 people

- Most common group size was 2

- Majority companions (65%) are family relations – **suggest strong bonds!**

- Most common relationship (40%) was spouse

AASK V4.0 : Family groups

- 16 families of '2 parent 2 children' were found.

- These families displayed a variety of evacuation behaviours.

  – 10 families evacuated as a group,

  – 6 split into smaller groups and used different exits

- While not conclusive, the results suggest that the family should be treated most commonly as a unit staying and evacuating together.

- Major implications for certification and experimentation. This is currently ignored by regulators.
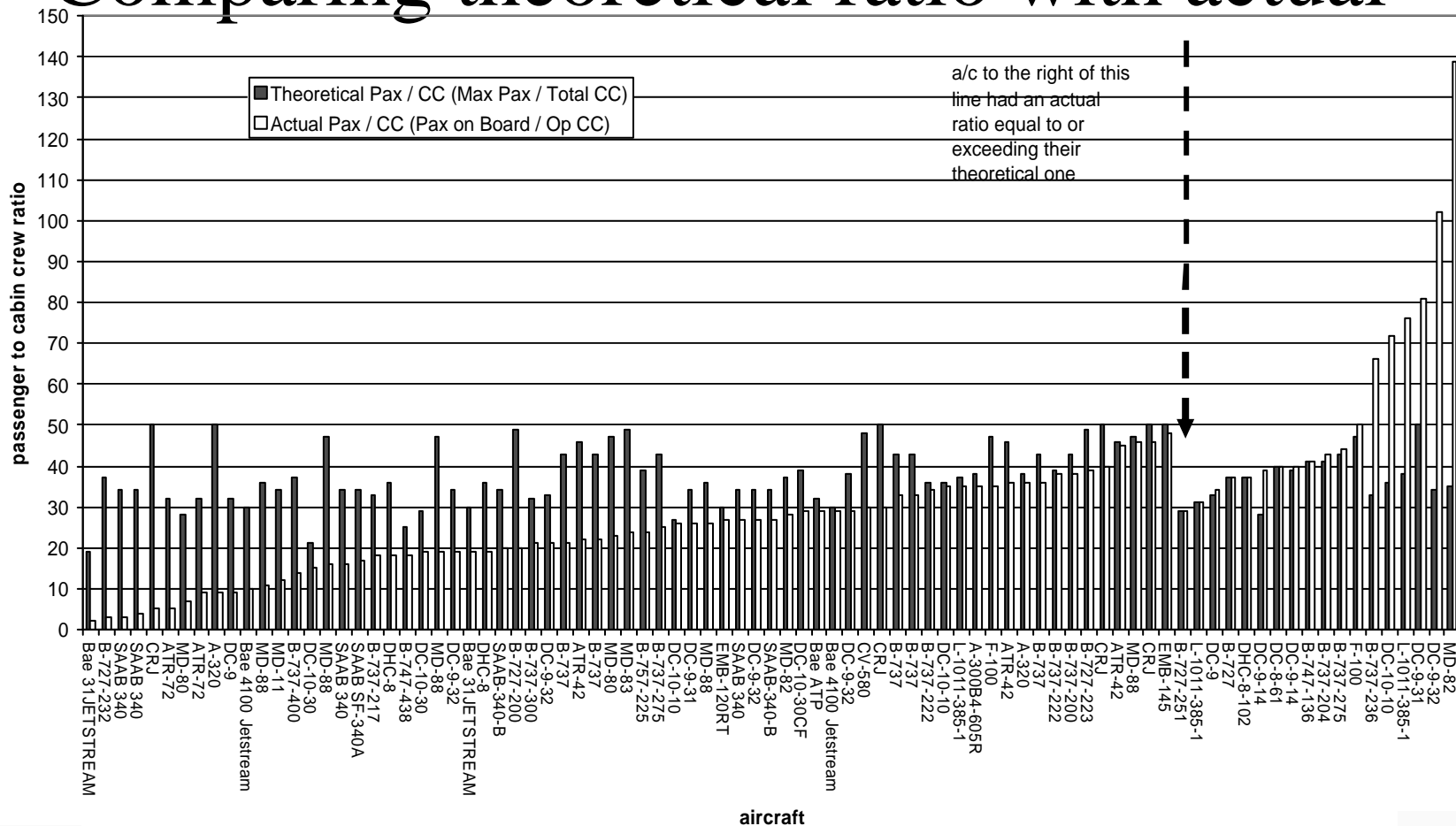
AASK V4.0 : Cabin crew staffing levels
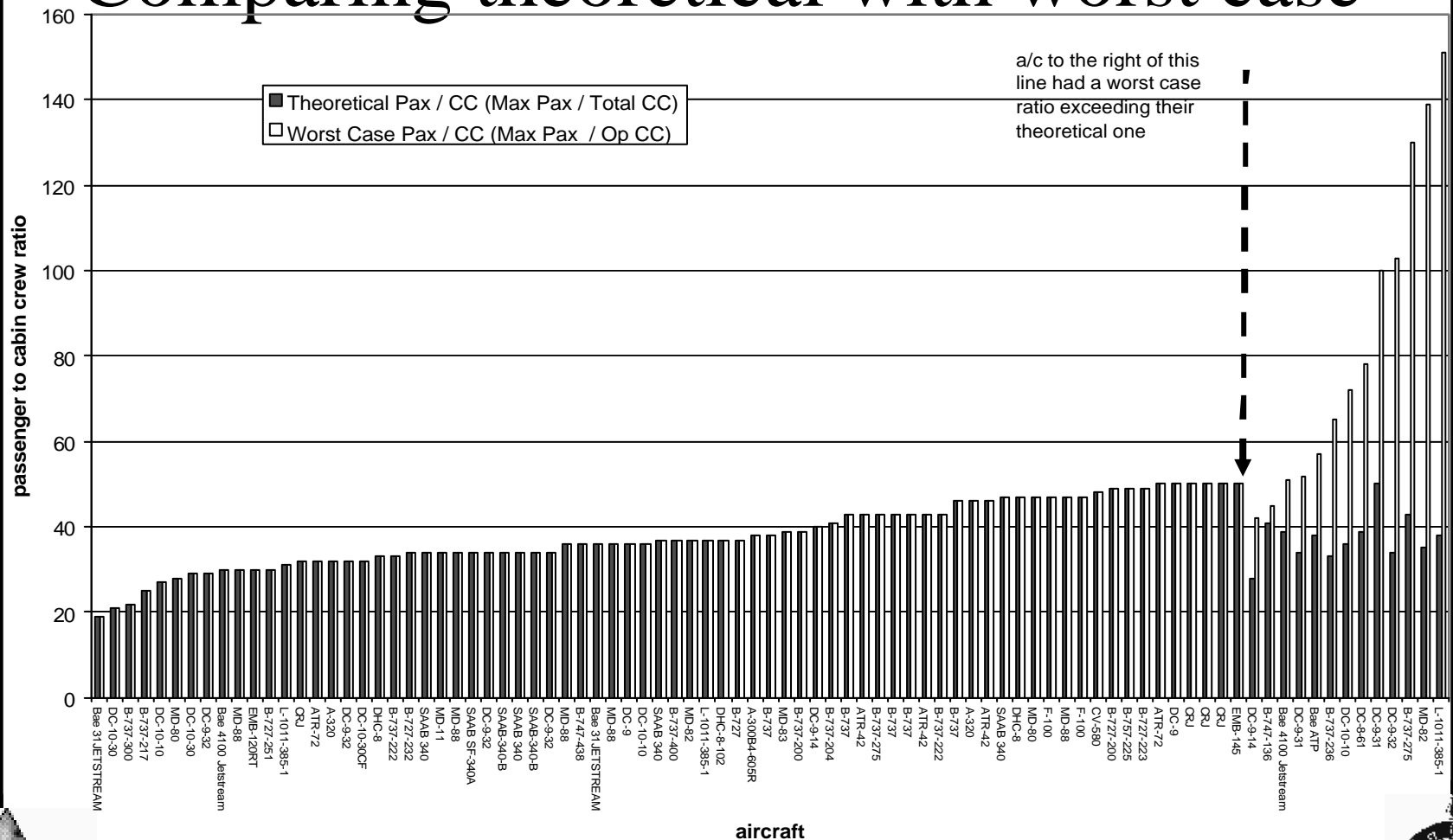
- Define 3 types of pax:crew ratios:
  - Theoretical: **max pax/max crew**
  - Actual: **pax on board/operational crew**
  - Worst case: **max pax/operational crew**
- Operational crew are those who can function and assist manage the evacuation (i.e. alive and not seriously injured)
- Internationally accepted pax:crew ratio
  - vary from 36:1 to 50:1.
- AASK has data from 87 accidents suitable for analysis
- 9 cases resulted in the partial loss of crew members.
- From analysis we find the following distribution of pax:crew ratios
  - **Theoretical:**   min 30:1; max   50:1
  - **Actual:**   min   2:1; max 139:1 (Jetsream, 2 pax+1 cc) (MD-82, 139 paxs+1 uninjured cc)
  - **Worst case:**   min 21:1; max 151:1

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AASK V4.0 : Results of Analysis-Comparing theoretical ratio with actual

Legend:
- Theoretical Pax / CC (Max Pax / Total CC)
- Actual Pax / CC (Pax on Board / Op CC)

a/c to the right of this line had an actual ratio equal to or exceeding their theoretical one

Y-axis: passenger to cabin crew ratio

X-axis: aircraft

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AASK V4.0 : Results of Analysis- Comparing theoretical with worst case

a/c to the right of this line had a worst case ratio exceeding their theoretical one

Legend:
- ■ Theoretical Pax / CC (Max Pax / Total CC)
- □ Worst Case Pax / CC (Max Pax / Op CC)

passenger to cabin crew ratio

aircraft

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AASK V4.0 : Cabin crew staffing levels

- To summarise the AASK analysis:
  - 12 cases in which **Actual ratio** *worse than* **Theoretical ratio**
  - 13 cases resulted in **Worst Case** ratio *worse than* the **Theoretical ratio**
  - 11 cases in which **Worst Case** ratio > 50:1
  - 5 cases in which the **Worst case** scenario results in a *doubling* of the **Theoretical ratio**.

- Clearly desirable to maintain pax:crew ratio that is as low as practical as in the event of a serious accident it is possible that some cabin crew will be unable to assist in the evacuation.

- Actual ratios of 139:1 have been achieved and ratios of 151:1 are possible using today's regulatory standards!!

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AASK V4.0: Cabin crew numbers and evacuation efficiency

- Is there a relationship between the number of operational cabin crew and the efficiency of the evacuation?

- Relate evacuation efficiency with the average distance travelled by paxs.

- Define the following distance measures:
  - TSD (Theoretical Shortest Distance): distance from pax seat to their nearest *available* exit
  - ADT (Actual Distance Travelled): distance from pax seats to *actual* exit used

- If ADT = TSD then evacuation is efficient.

- However in general ADT > TSD

- Define Evacuation Efficiency (EE) as follows:
  - EE = TSD/ADT * 100%

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AASK V4.0 :Cabin crew numbers and EE

- Aircraft selected for analysis according to the following criteria:
  - Pax Loading > 50%,
  - Pax reply rate > 50%,
  - Small commuter aircraft with capacity < 30 paxs were excluded, and
  - Aircraft with ruptures providing alternative means of escape were excluded.
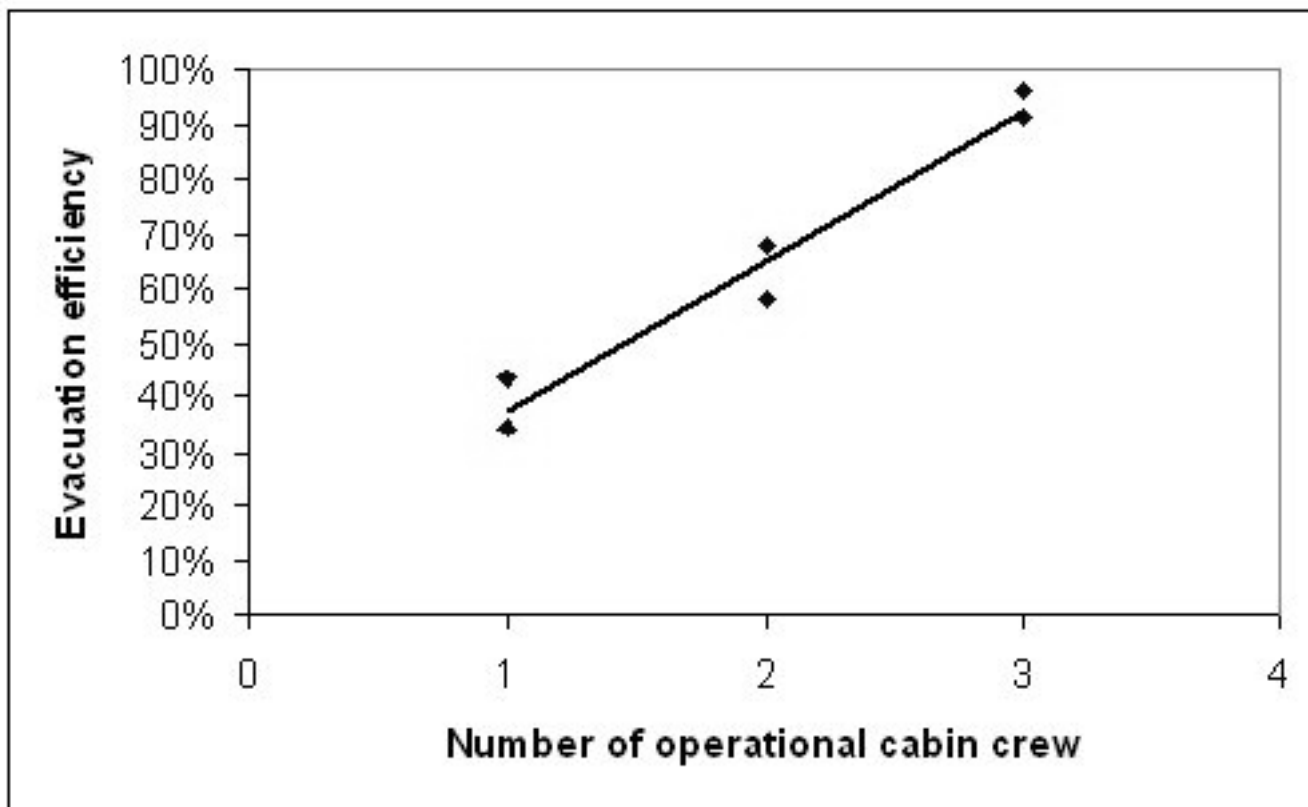
AASK V4.0: Cabin crew numbers and EE

- Only 6 aircraft meet the selection criteria.

- All of these are narrow body aircraft.

- No apparent correlation between EE and the actual passenger to operational cabin crew ratio.

- However, a strong correlation exists between between the number of operational cabin crew and the EE.

- In particular it is noted that when there are a small number of crew available to control the evacuation:
  - paxs tend to fail to make use of their optimal exits
  - and travel significantly further than necessary

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# AASK V4.0 : Results for 6 narrow body aircraft

AASK V4.0: Cabin crew numbers and EE

- With a single crew member paxs travelled **3X** further than necessary (on average)

- With three crew members paxs only travelled **1.1X** further than necessary (on average)

- This observation strengthens the earlier comment that the loss of even a single crew member could have a significant negative impact on EE.

- However, note:
  - only a small sample set available for analysis,
  - these accidents may not be generally representative of likely accident situations,
  - accidents considered here are only representative of narrow body aircraft,
  - EE is a complex parameter based on a number of variables, not simply the distance travelled to exit,
  - other factors may play a more important role in passenger exit selection then simply the presence of cabin crew.

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AASK V4.0 : Crew Numbers and EE

- Possible to extend analysis by relaxing the selection criteria.
- Only enforce the condition requiring pax loading > **50%**
- 17 aircraft now included in analysis.
- Now includes 4 wide body aircraft.
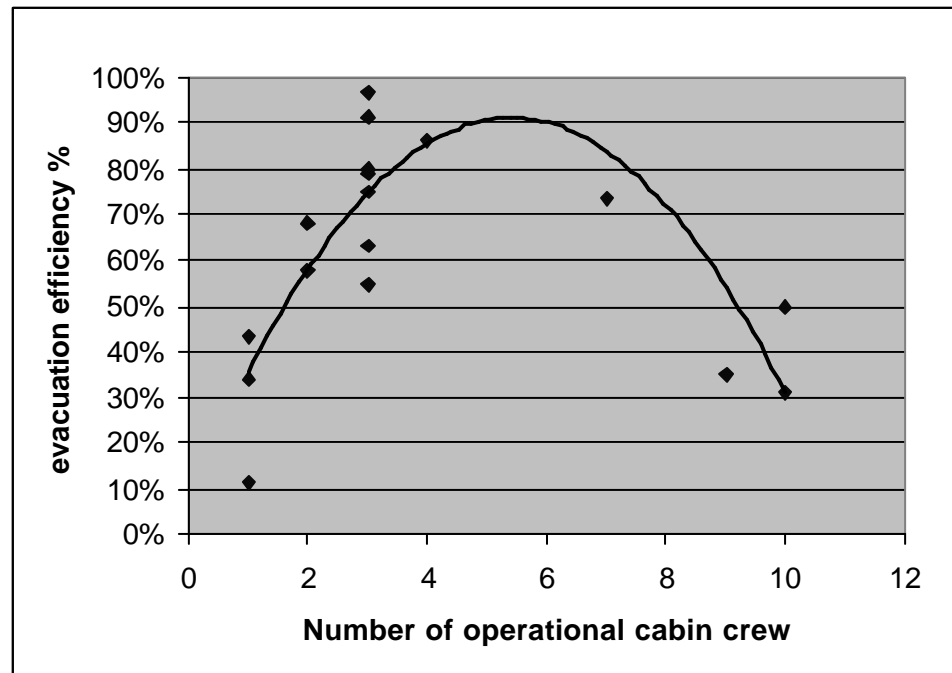
AASK V4.0: Cabin crew numbers and EE

- Previous relationship no longer valid.
- With very large number of crew EE begins to decrease.
- However, all narrow body aircraft fit original trend
- 4 cases with contra indication are wide body aircraft.
- Possible explanations include:
  - more complex cabin geometry resulting in more exiting options,
  - greater use of bypass
  - potential conflicts between orders given by different crew in different cabin sections
  - Perhaps EE definition not appropriate for wide body aircraft situation.
- These conclusions are tentative as:
  - They are based on a small sample and
  - Selection criteria is quite weak.

AASK V4.0 : Nearest Exit Usage

– Aviation industry had assumed paxs tended to use their boarding exit for evacuation - most familiar!

– AASK contains 879 paxs who reported exit usage and their starting location

– **588 paxs (67%) *did* use their *NEAREST EXIT***

– Of the 291 pax who did not use their nearest exits, 190 supplied reasons for their actions, these include:

    * 35:   nearest exit was blocked
    * 53:   followed FA instructions
    * 27:   followed other passengers
    * 27:   thought the exit they used *was* their nearest exit
    * 16:   shorter queue than at nearest exit
    * 11:   choice made before egress

– **Data suggests 89% 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 6.9 seat rows.

- PAX who select their nearest exit travel on average 4.7 seat rows – excluding those in exit rows (if they travel forward, 4.4 seat rows if they travel aft 5.1 seat rows)

- PAX who do not use their nearest exit travel on average 11.1 seat rows.

- 60% of PAX went forward, 34% went aft (others in exit row). Does this mean PAX prefer to travel forward?

- ## NO!

- Of PAX that move forward, 64% select their nearest exit.

- Of PAX that move to the rear, 67% select their nearest exit.

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

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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 89% 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 V4.0 : Results of Analysis-Exit usage in 3 pair configuration
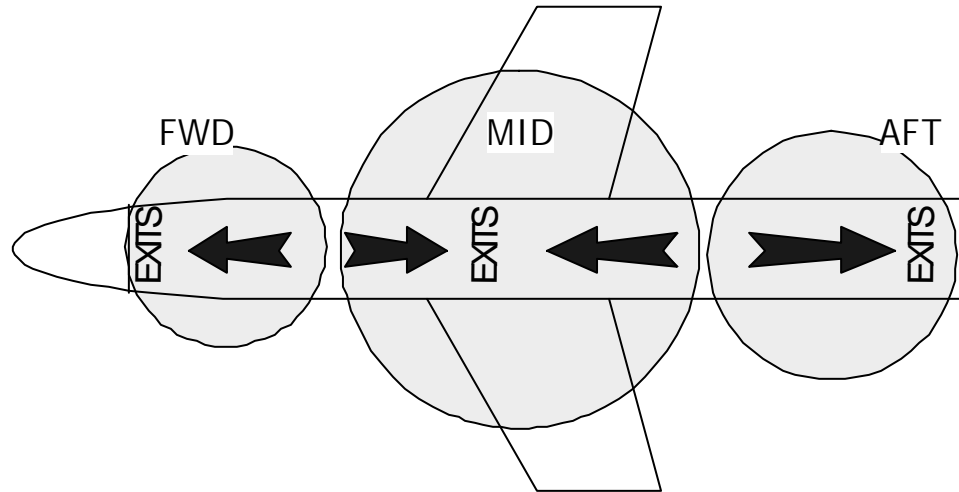
- Accidents used involved high passenger loading, authorised evacuations and minimal redirection.

- The behaviour contrasts with that observed in trial evacuations where even passenger distribution is essential

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AASK V4.0 : Exit usage in 3 pair configuration

Trials

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

Accidents

Accident	Loading	Fwd (%)	Mid (%)	Aft (%)
B-737-222	93.6%	19.2	61.5	19.2
B-737-222	96.6%	39.5	37.2	23.3
B-727-223	79.5%	23.6	58.3	18.1
B-737	78.1%	17.3	48.3	34.5
Mean	**87.0%**	**24.9**	**51.3**	**23.8**

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AASK V4.0 : Overall Exit Usage

- Analysis of 42 accidents:
  - Involving intact aircraft not in water
  - Involving aircraft with 3 or 4 exit zones.

- Main results:
  - 14 (33.3%) had less than 50% of exits available;
  - 7 (16.6%) had exactly 50% of exits available and
  - 21 (50%) had more than 50% exits available.

- 23 (55%) accidents had a cabin section in which no exits were available.

- Only in 3 (7%) cases were all the exits available on one side of the aircraft.

- *This has major implications for evacuation certification.*

AASK V4.0 : Seatbelt difficulty

Category	Gender	Number	Mean Age (yrs) * <18 included	No Age Data
PROVIDED HELP TO OTHER PAX	M	18	42.4*(40.4)	3
	F	8	38.9	1
DIFFICULTY – REQUIRED NO HELP	M	33	43.8	10
	F	22	43.2*(41.5)	2
DIFFICULTY – REQUIRED HELP	M	10	44.0*(39.3)	3
	F	20	44.7*(40.4)	1

- 111 passengers had experiences related to seat belt difficulties

- Age was not a factor

- Gender was a **significant** factor relating to seatbelt difficulty

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AASK V4.0 : Seat climbing

- *Data on seat climbing often not reported as investigators do not ask the question and interviewees often do not think it is important!*

- 91 paxs noted as climbing seats

- 73 of these in accidents with major fires and damage to the aircraft

- Behaviour most likely to occur within 2 rows of an exit

Number of passengers	Number of seats climbed
23	1
4	2
4	3
2	5
1	13
57	No information

AASK V4.0 : Seat climbing

- Mean age of seat climbers is 32.9 years
- Mean survivor age is 40.3 years
  - suggests only younger paxs attempt to climb seats
- Females represent 59% of those climbing seats which was a change to the previous study where no gender difference was found
- This bias may be explained by a large choir group on one of the new accidents which accounts for 43/91 of the seat climbing incidents.

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AASK V4.0 : Seat climbing

- Rationale for seat climbing provided by 42 paxs including:

  `*People were filled in the aisle. The person next to me hurdled the chairs, so I followed him'.*

  `*I first started to go across the aisle but this exit was blocked with passengers. I then decided to climb over a couple of seats and try to go out of the front'.*

  '*The doors at first did not pop thenpeople forced them open. She clibed over the back of her seat and 'hoped' out*'

Reason Cited	No. Males	No. Females
N/D (No reason given)	19	29
SHORTEST ROUTE TO EXIT	**12**	**5**
AISLE TOO CONGESTED	4	5
AISLE BLOCKED BY ACCIDENT DAMAGE	1	3
QUEUE MOVING TOO SLOWLY	1	0
ROUTE TO AISLE BLOCKED BY PAX	0	3
ENVIRONMENTAL (e.g. smoke)	0	3
AISLE BLOCKED BY DEBRIS	1	4

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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,

  •aid in the design of more realistic aircraft evacuation computer models.

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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

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AASK V4.0 : Survivor and Fatality Comparisons

- Four aircraft were found with sufficient data:

    – B737-300 (63 Survivors and 20 fatalities)

    – DC 9-20 (33 Survivors and 7 fatalities)

    – DC 9-32 (18 Survivors and 23 fatalities)

    – B737-236 (76 Survivors and 52 fatalities, excluding infants).

- All involved fire and were narrow bodies

- The theoretical travel distance refers to distance from the passenger's starting location (seat row) to the nearest *available viable* exit.

- The overall mean theoretical travel distance for survivors (based on a weighted mean) in these accidents is 2.89 seat rows, while the theoretical mean travel distance for fatalities is 5.31 seat rows (assuming passengers attempted to use their nearest viable exit).

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AASK V4.0 : Results of Analysis- Survivor and Fatality Comparisons
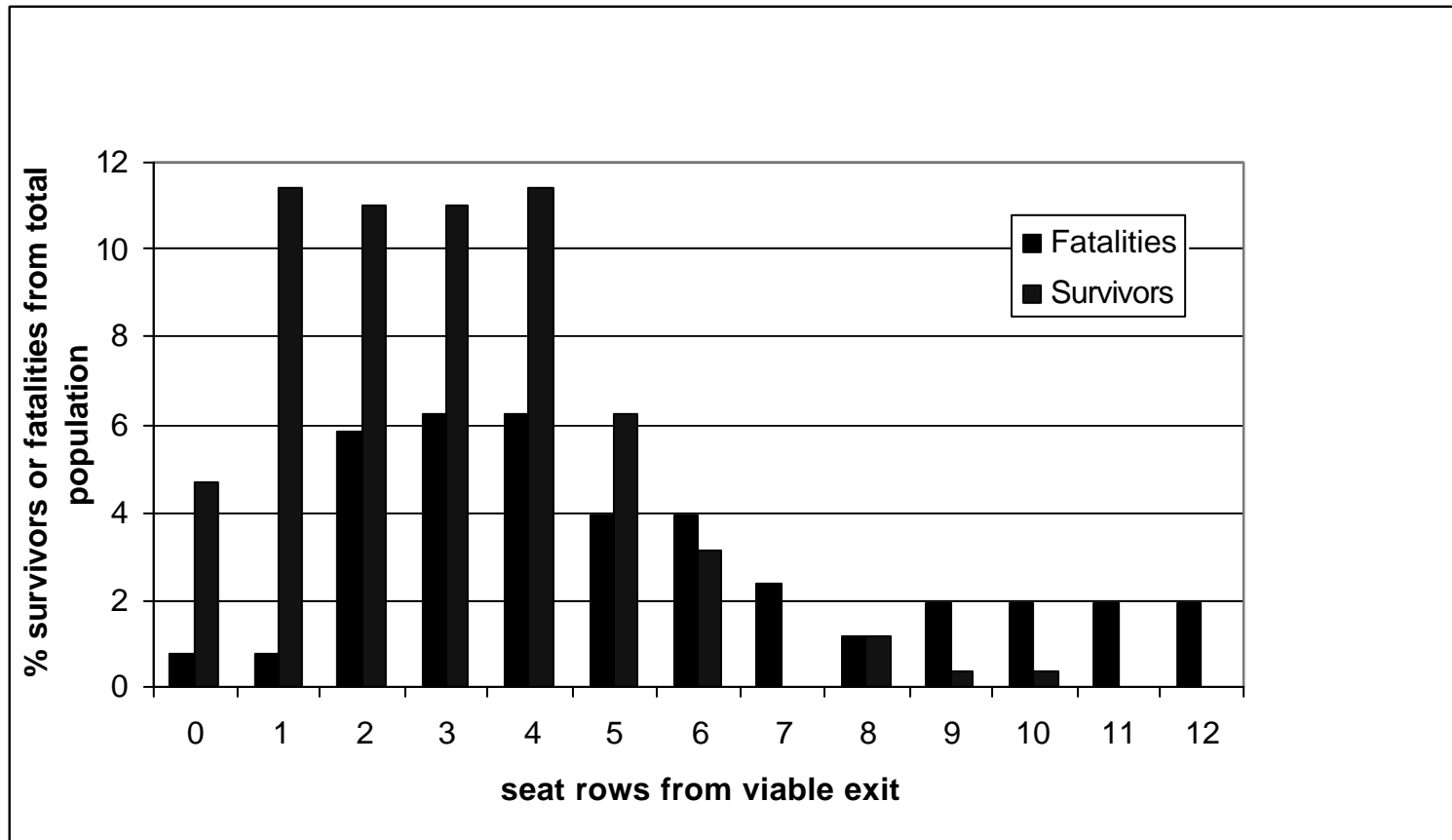
AASK V4.0 : Results of Analysis-Aisle & non aisle survivor comparisons

Aircraft	Survival Rate of Aisle Seated Passengers	Survival Rate of Non-Aisle Seated Passengers
DC9-32	38%	48%
B737-236	62%	57%
B737-300	86%	61%
DC9-20	71%	70%
AVERAGE	64%	58%

Only a marginal advantage in being located on an aisle

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AASK V4.0 : Results of Analysis-Forward and aft survivor comparisons

Aircraft	Survival Rate of Front Seated Passengers	Survival Rate of Rear Seated Passengers
DC9-32	33%	100%
B737-236	87%	30%
B737-300	53%	89%
DC9-20	75%	67%
AVERAGE	65%	53%

The advantage in being located forward varies greatly

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

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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 second Cabin Safety Conference.

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AASK: Development

- **AASK V3.0**
  - Continued support from UK CAA lead to the refinement of database.
  - Additional accidents added to database
  - Seat Plan Viewer added
  - Internet capability.
  - Query engine facilitating Data Mining over the internet
  - Reported at the third Cabin Safety Conference.

- Continued support from the UK CAA has lead to the development of **AASK V4.0.**

AASK V4.0 : Results of Analysis-Exit usage reasons

Reason for Exit Choice	Number of Passengers
N/A (e.g. rescued)	3/5
Nearest exit was/became unavailable	35/54
Followed Attendant instructions	53/72
Followed other passengers	27/38
Shorter queue than other exits	16/20
Choice made before egress	11/16
Passenger thought this was his/her nearest exit (when it was not)	27/37
Found exit during egress	9/12
Followed emergency lights	4/4
Only available exit	5/6
Followed companion	2/2
Helped through exit	1/7

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AASK V4.0 : Results of Analysis- Distance and Direction to Exit

Direction	# Pax	Travelled Min. Distance?	# Pax	Mean Distance
Forward	530 / 866	Yes	339 / 540	4.4 / 4.5
		No	191 / 326	11.3/ 12.4
Aft	300 / 511	Yes	200 / 334	5.1 / 4.9
		No	100 / 177	10.7 / 11.3
Exit Row	49 / 64	Yes	49 / 64	0

- Passengers NOT choosing their nearest exit travel nearly twice as far
- The desire to move to the nearest exit may interact with cabin crew instructions

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AASK V4.0 : Updates from AASK V4.0

- **More accident data available**

|	AASK V2.0	AASK V3.0	AASK V4.0
All accidents	**25**	**55**	105
Fatalities	205	679	815
(seriously injuries	139	255	320)
(minor injuries	329	712	903)
(uninjured	1742	3888	7317)
Survivors	2210	4855	8540
All passengers	**2415**	**5534**	**9355**
Fatalities entered		**327**	**338**
All pax entered	**669**	**1295**	1917
Cabin crew	**36**	**110**	155

AASK V4.0 : Results of Analysis

- Category of co-worker has increased from V3.0 possibly due to the inclusion of a large number of commuter flights in the data from the NTSB study

- Mean group size was 2.4 people (down from 2.7 in V3.0)

- Most common group size was 2

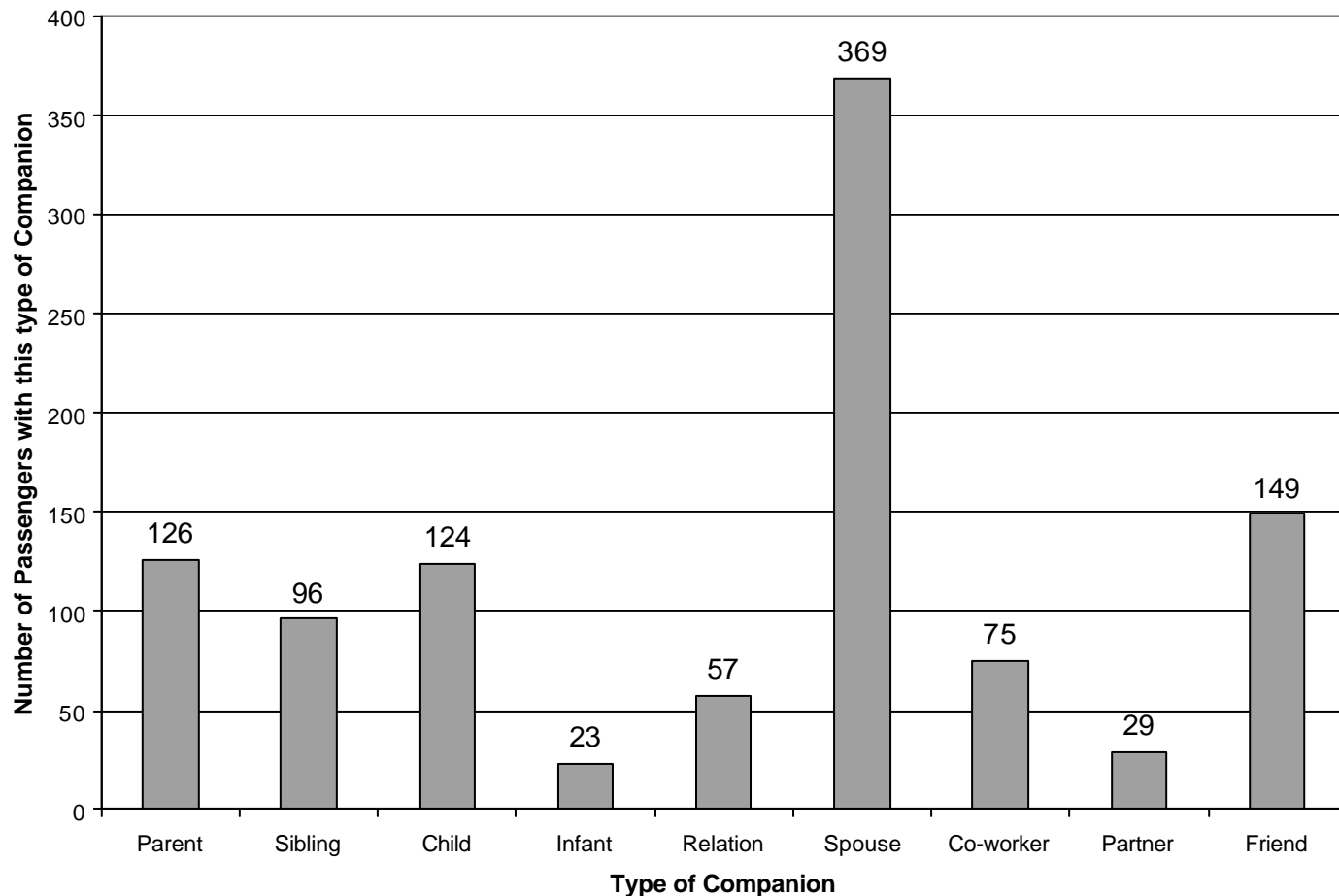**FSEG**

AASK V4.0 : Results of Analysis-Travelling companions
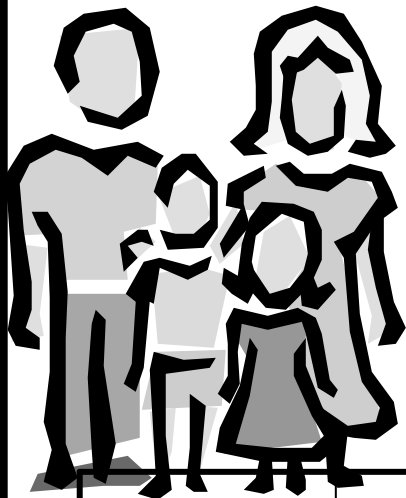
- From 947 passengers 1048 companion type references were noted

Pax	spouse	child	parent	sibling	references
Mr T	1	2			2
Mrs T	1	2			2
Mstr T			2	1	2
Miss T			2	1	2

AASK V4.0 : Results of Analysis- Travelling companions

Bar chart showing Number of Passengers with this type of Companion (y-axis, 0 to 400) by Type of Companion (x-axis):
- Parent: 126
- Sibling: 96
- Child: 124
- Infant: 23
- Relation: 57
- Spouse: 369
- Co-worker: 75
- Partner: 29
- Friend: 149

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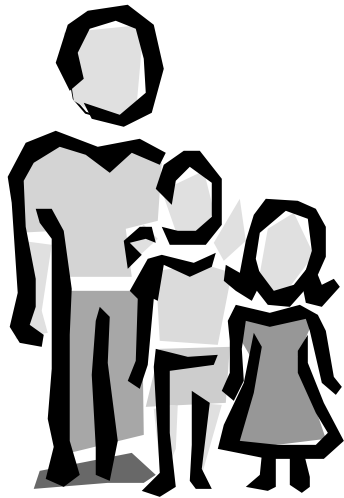# AASK V4.0 : Results of Analysis-Travelling companions

- From 947 passengers 1490 different companion relations were noted with possibilities for assistance

Pax	spouse	child	parent	sibling	companions
Mr T	1	2			3
Mrs T	1	2			3
Mstr T			2	1	3
Miss T			2	1	3

AASK V4.0 : Results of Analysis- Assistance to companions

A father helping both his children would count as 2 separate instances of assistance

- Of the 947 passengers travelling with companions 87 (9%) rendered assistance in 104 cases

- This represents a reduction over previous analysis (13%) due to the higher proportion of business travellers

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AASK V4.0 : Results of Analysis-Assistance to companions

Companion type to whom assistance was rendered.	Incidences of passengers rendering assistance in this category.	For those giving assistance, details of their relationship to the companion, where stated.	Gender of those giving assistance	
			Female	Male
Infant < 2 yrs	7	6 mothers, 1 father	6	1
Child	31	11 mothers, 15 fathers, 5 f	16	15
Sibling	6	1 sister, 5 brothers	1	5
Parent	6	1 daughters, 5 sons	1	5
Spouse	24	1 wife, 23 husbands	1	23
Partner	5	1 f, 4 m	1	4
Relation	8	1 gr-daughter, 2 aunts, 3 f, 2 m	6	2
Friend	14	3 f, 11 m	3	11
Unknown	3	1 f, 2 m	1	2
TOTAL	**104**		**36**	**68**

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AASK V4.0 : Results of Analysis- Assistance to companions

- Assistance given in 65% cases by males, 68/104 incidents

- Only in the categories of assistance to children and other relations do females outnumber males

- In nearly all cases 23/24 of assistance between spouses it is the husband who assists the wife

- However note this analysis only refers to a selected 87 of the passengers who were involved in assistance

AASK V4.0 : Results of Analysis- Family groups

- Passengers travelling in family groups make up 32% of the passengers in AASKV4.0, 609/1917

- Bonding in families may affect evacuation behaviour (as found by Johnson)

- 16 families of '2 parent 2 children' type were found

- 10 evacuated as a group, 6 split to use different exits

- The family (or companion) bond is not always maintained during evacuation.

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AASK V4.0 : Exit availability in 3 pair configurations

- 12 accidents were included in this analysis on exit availability.

- Excluded were
  - those that ended up in water
  - where there was substantial damage to the fuselage
  - where information about the condition of an exit was missing
  - passenger initiated evacuation
  - orchestrated 'artificial' scenarios (e.g.pax directed to use 1 exit)

- the exit is only considered to be 'available' when the exit and its evacuation assist means are physically and fully/safely functional, and passengers are permitted to use it by cabin crew.

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AASK V4.0 : Results of Analysis-Exit availability in 3 pair configurations

	Availability (%) of exit in exit pair.		
Exit Position	**No Exits**	**One Exit**	**Both Exits**
FWD	8.3%	41.7%	50.0%
MID	8.3%	33.3%	58.3%
AFT	25.0%	33.3%	41.6%

- All cases included here have a strict arrangement of exit pairs in forward, mid and aft positions.
- The results contrast with the certification trials where there is always one exit available in a pair
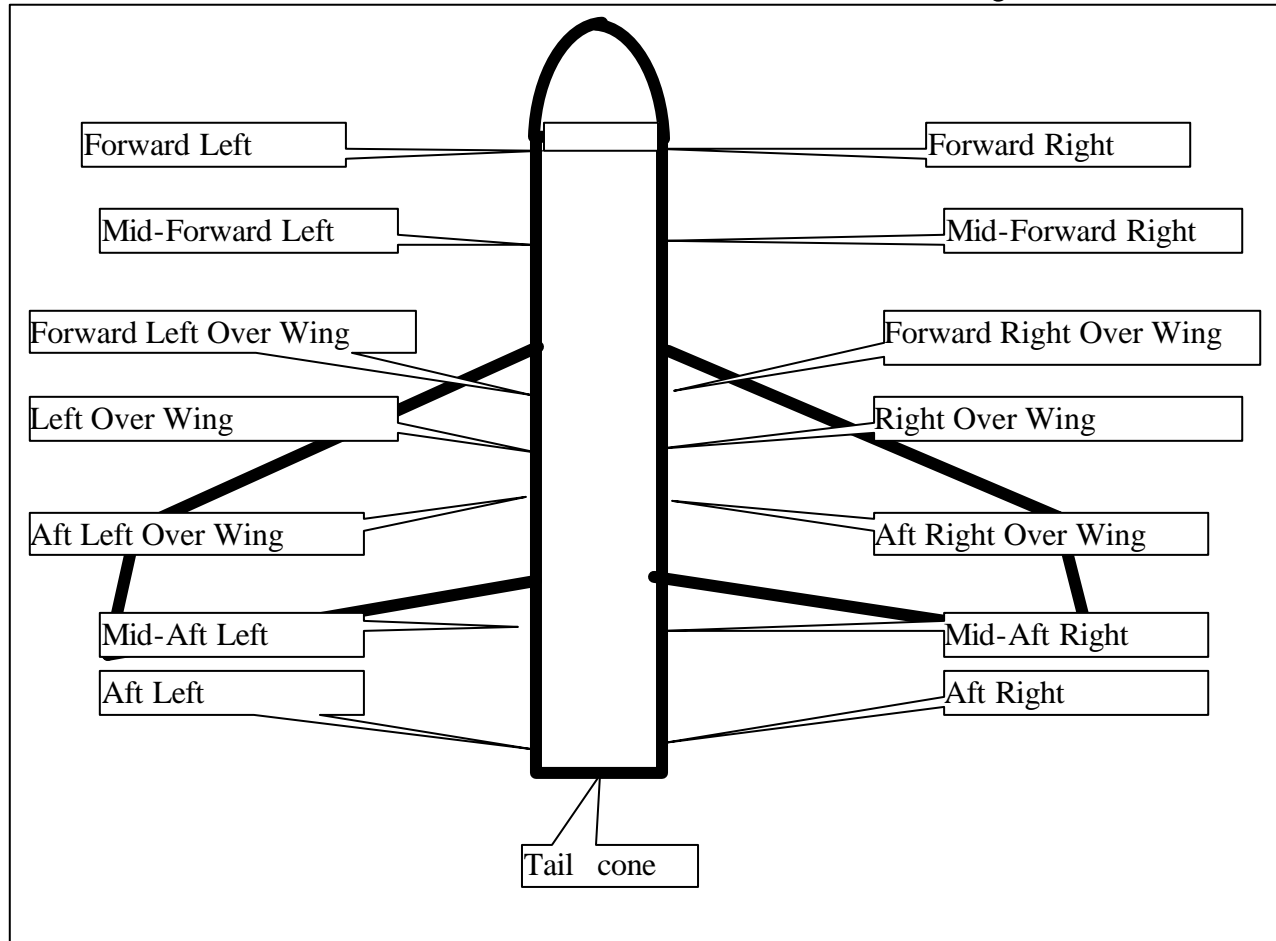
AASK V4.0 : Results of Analysis- Exit availability in 4 pair configurations

Exit Position	Availability (%) of exit in exit pair.		
	No Exits	One Exit	Both Exits
FWD	0%	28.6%	71.4%
MID- FWD	0%	28.6%	71.4%
MID-AFT	28.6%	57.2%	14.3%
AFT	28.6%	42.9%	28.6%

- Similar analysis was carried out on 7 aircraft with 4 exit pairs

- Certification trials could be made more challenging whilst maintaining the 50% exit rule by altering configurations of available exits

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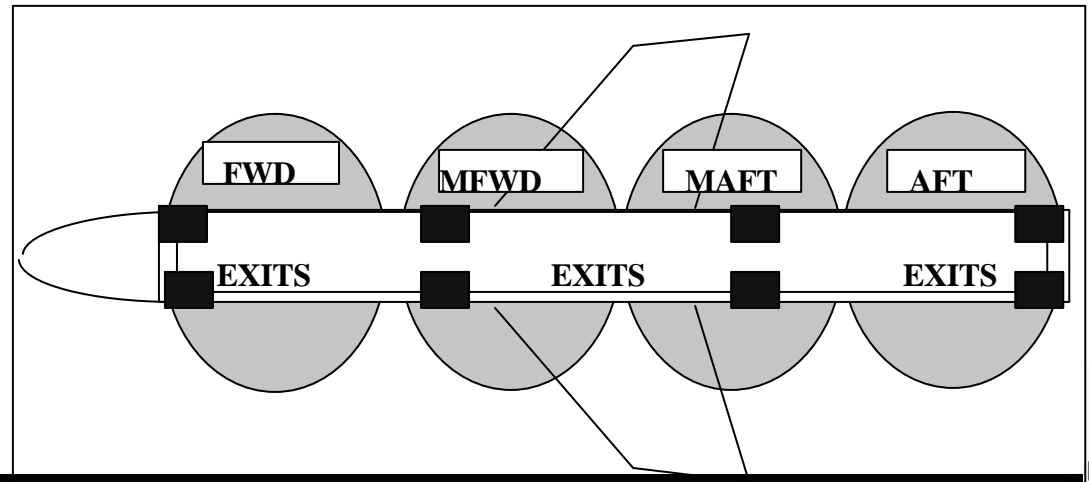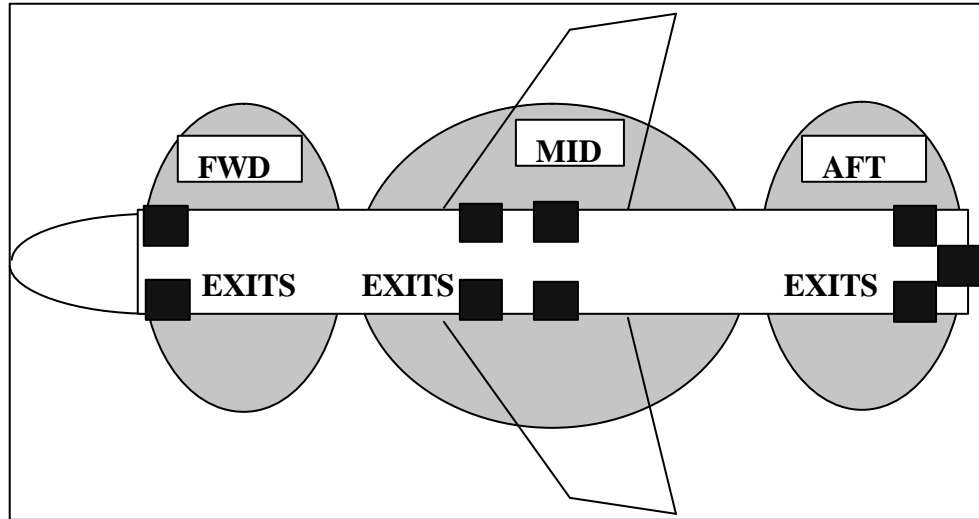# AASK V4.0 : Results of Analysis- Total Exit availability

Forward Left

Forward Right

Mid-Forward Left

Mid-Forward Right

Forward Left Over Wing

Forward Right Over Wing

Left Over Wing

Right Over Wing

Aft Left Over Wing

Aft Right Over Wing

Mid-Aft Left

Mid-Aft Right

Aft Left

Aft Right

Tail cone

All exits and positions considered in AASK

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AASK V4.0 : Results of Analysis-3 and 4 Exit Zones definitions

FWD   MID   AFT

EXITS   EXITS   EXITS

FWD   MFWD   MAFT   AFT

EXITS   EXITS   EXITS

FSEG

AASK V4.0 : Results of Analysis-Overall Exit Usage

- Combining the results for aircraft with three and four exit zones, 42 aircraft were found suitable for examination,
    - 14 (33.3%) had less than 50% of exits available;
    - 7 (16.6%) had exactly 50% of exits available and
    - 21 (50%) had more than 50% exits available.

- Of the 42 aircraft considered, 23 (55%) had a cabin section in which no exits were available.

- Only in 3 (7%) cases were all the exits available on one side of the aircraft.

AASK V4.0 : Results of Analysis-Slide and Exit malfunction

- From the 155 cabin crew accounts 43 mention difficulty with exits, slides or both. Of these 42 cite equipment failure

- From the 105 accidents in AASK V4.0 exit or slide malfunctions were mentioned in 28

- The majority of incidents were door jamming while the remainder were concerned with poor slide performance

- Problems with crew operated doors were cited in 22 accidents by 30 crew representing 31 exits

- In AASK there are a total of 258 crew operated exits so this represents about 12%

- However crew did not attempt to open all exits due to the accident conditions and only 174 exits were tried. So the 31 failures represent 18% or nearly one fifth of all exits tried.

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AASK V4.0 : Results of Analysis- Slide and Exit malfunction

- Associated with the of 258 crew operated exits there are 226 slides.

- Cabin crew mentioned difficulties with 20 slides (including slide failure to inflate, slow inflation time, or failed after initial deployment) in 17 accidents. This gives a slide malfunction rate of 8.9%

- However crew did not attempt to use all the slides due to the accident conditions and only 137 slides were tried. So the 20 failures represent a malfunction rate of 15%.

- That there should be such a relatively high incidence of problems associated with the exiting systems on board aircraft is cause for concern and requires further investigation.

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AASK V4.0 : Results of Analysis-Slide and Exit malfunction
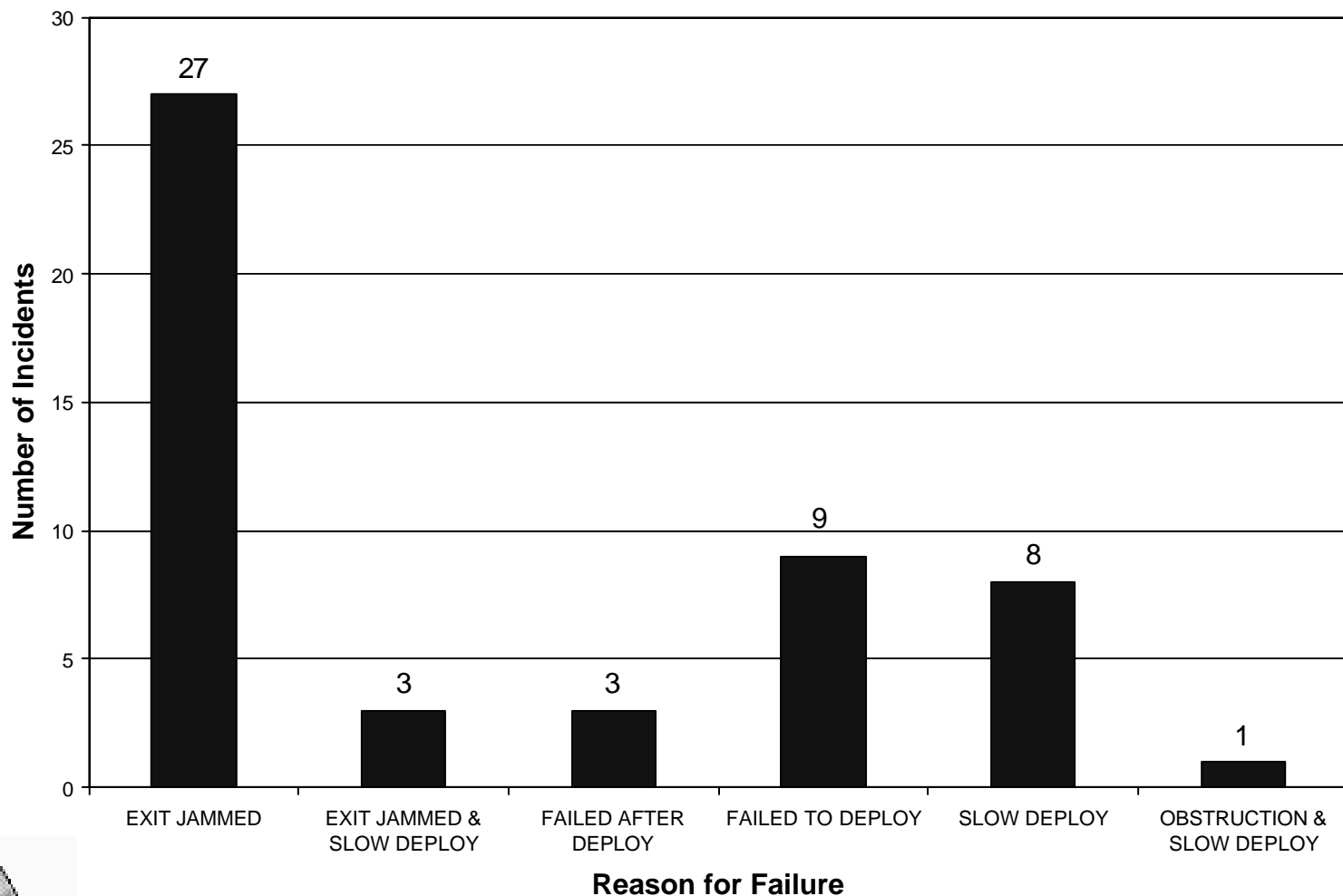
AASK V4.0 :Users and feedback

- Currently there are over 30 users from nine countries registered to use AASK

- Online questionnaires are available and the help facility gives users access to expertise

- Presentations and demonstrations at CAA in Jan 2003 proved valuable for suggestions

- A workshop was run in April 2003 which gave further feed back and introduced AASK to a wider audience. This was international in nature and although it was affected by travel restrictions due to the SARS crisis there was good feedback.

  - *"Great database it will really save me some time"*

  - *"Excellent clearly there is some potential for using this tool for data derived safety regulation"*

FSEG

AASK V4.0 : Results of Analysis-Evacuation Efficiency

- To be representative, accidents were excluded where:
  - Loading was less than 50%
  - Passenger reply rate was less than 50%
  - They involved a commuter aircraft with a capacity of less than 30 pax
  - The aircraft had ruptures providing alternative means of escape
- This left five suitable accidents all with a single aisle
- The results show an apparent rise in efficiency correlated with larger numbers of operational cabin crew

Aircraft	Max passengers	Passengers on board	Cabin Crew on board	Operational cabin crew	Theoretical pax/cc ratio	Actual pax/cc ratio	Evac Eff
SAAB-340-B	34	20	1	1	34	20	34%
B-737-300	128	83	4	3	32	28	91%
DC-9-20	78	40	2	1	39	40	43%
B-737-236	130	131	4	2	33	66	58%
B-727-223	146	116	3	3	49	39	96%

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AASK V4.0 : Example Accident

Accident Selection: [_____ ▼]

Accident Date: [14-Apr-93]   Flight No: [102]   INDEX: [1993414102]

Accident location: [DALLAS/FORT WORTH INT A/P TEXAS ▼] *   Accident Time: [6:59]   (leave blank if unknown)

Aircraft Type: [DC-10-30 ▼] *   Aircraft Manufacturer: [McDONNELL DOUGLAS ▼] *

Aircraft Operator: [AMERICAN AIRLINES ▼] *   Flight Type: [SCHEDULED ▼]

Flight Destination: [DOMESTIC ▼]   Category: [INTACT, EXTERNAL FIRE ▼]

Acc Flight Position: [LANDING ▼]   Hull Position: [OFF END/SIDE OF RUNWAY ▼]

Aircraft Orientation: [LEFT SIDE DOWN ▼]   Orientation Angle: [10]

Investigation Authority: [NTSB ▼] *   Report Date: [14/4/93]   (leave blank if unknown)

Report Author: [CARL W. VOGT ▼] *   Accident Designation: [AAR-94/01]

Max Passenger Load: [290]

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
Fatal	0	0	0	0	0
Serious	0	0	2	0	2
Minor	1	2	35	0	38
None	2	8	152	0	162
Total	3	10	189	0	202

Record: [◄◄] [◄] [1] [►] [►►] [►*] of 55

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AASK V4.0 : 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: 7   Accident: 3

Data Source: FULL TRANSCRIPT ▼

Gender: MALE ▼   Age: 29   0=infant (<2yrs)
999=unknown

Weight (kg): 86   Or (lb):

Height (cm): 188 Or (inches):   0=unknown

Seat Row: 5   Seat Label: A ▼   Assumed Seat: ☐   Basic Info Notes:

Disabilities: N/D ▼

Flight Experience: N/D ▼

Pre-flight Briefing: N/D ▼

Occupation: PROFESSIONAL ▼

Record: |◀ ◀ | 7 | ▶ ▶| ▶* of 36

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AASK V4.0 : 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 Sevrice: 0

Extra Months of Service: 0   Total Months of Service: 102

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

Seat Location: SEAT BY EXIT   Seat Type: JUMP

Nearest Seat Row: 1   Nearest Seat Label: A

Role: DOOR ASSIGNED ATTENDANT   Region of Responsibilty: FORWARD

Primary Assigned Exit: FORWARD LEFT   Secondary Assigned Exit: FORWARD RIGHT

Record: 1 of 10

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AASK V4.0 : Example Fatalities

Update Fatalities

Fatality ID: 39   Accident: 6

Fatality Number: 2

Fatality Type: PASSENGER   Gender: MALE   Age: 36   0=infant (<2) 999=unknown

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

Weight (kg): 0   OR (lb):

Seat Row: 1   Seat Label: (Enter 999 Z if Unknown)   2   1

(Enter Absolute Values, 0=unknown)

Body Location: N/D   Abs Row of Body: 0   Abs Column of Body: 0

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

CO (%): 999   HCN (ppm): 999   CO2 (%): 999

Cause Of Death: N/D   Details: MULTIPLE BLUNT FORCE IMPACT INJURIES. MULTIPLE FRACTURES AND LACERATIONS.

Notes:

Record: 2 of 110

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AASK V4.0 : Seat Plan Viewer

AASK V4.0 : Seat Plan Viewer

Information about the companions of the selected passenger in 12B

AASK V4.0 : Seat Plan Viewer

Exit View Print Help

Select an accident | Id = 10, Date = 12-Nov-95 ▼ | View accident details | View aircraft layout
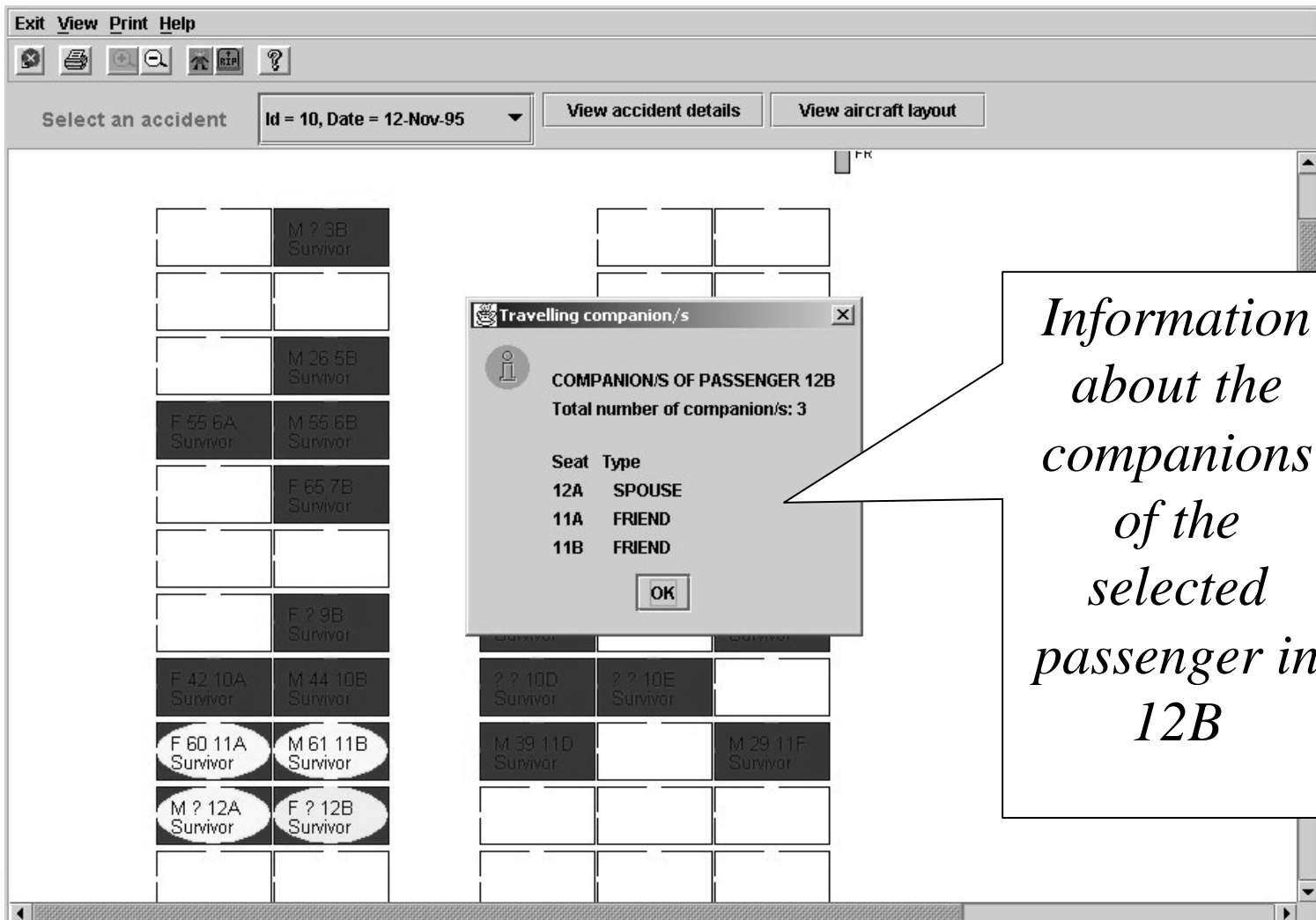
Layout of MD-83 12-Nov-95

FL

FR

| M ? 3B Survivor |

| M 26 5B Survivor |

F 55 6A Survivor | M 55 6B Survivor

| F 65 7B Survivor |

Exit used information

ℹ Exit FL used by:

45 passenger/s

OK

F ? 8F Survivor

| F ? 9B Survivor | M ? 9D Survivor | M 31 9F Survivor

F 42 10A Survivor | M 44 10B Survivor | ? ? 10D Survivor | ? ? 10E Survivor

F 60 11A | M 61 11B | M 39 11D | M 29 11F

Graphical display to show all passengers using the forward left exit and a dialogue box giving the total using this exit
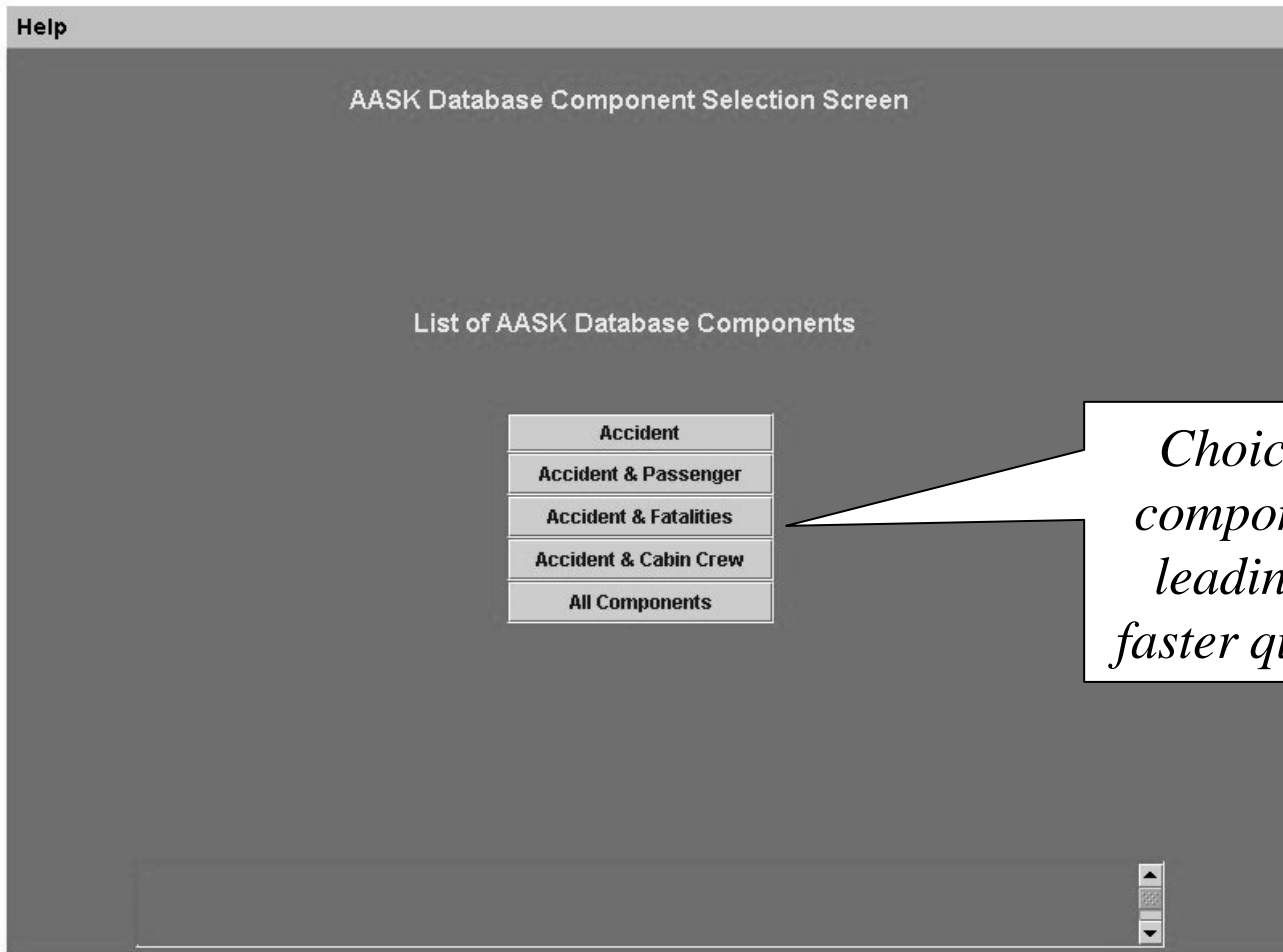
AASK V4.0 : Seat Plan Viewer

- Additional Features
  - **Password protection** - only available to authorised users,
  - **Accident information** such accident dates, identity number and aircraft type is displayed,
  - **Survivors and/or fatalities** can be viewed,
  - **Zoom in and zoom out** facility – the plan for wide bodied aircraft can be quite crowded if it is to fit to one screen so this zoom feature provides for improved legibility,
  - **Aircraft plan** print facility,
  - **Travelling companions** all companions of a particular passenger can be displayed in their seat positions
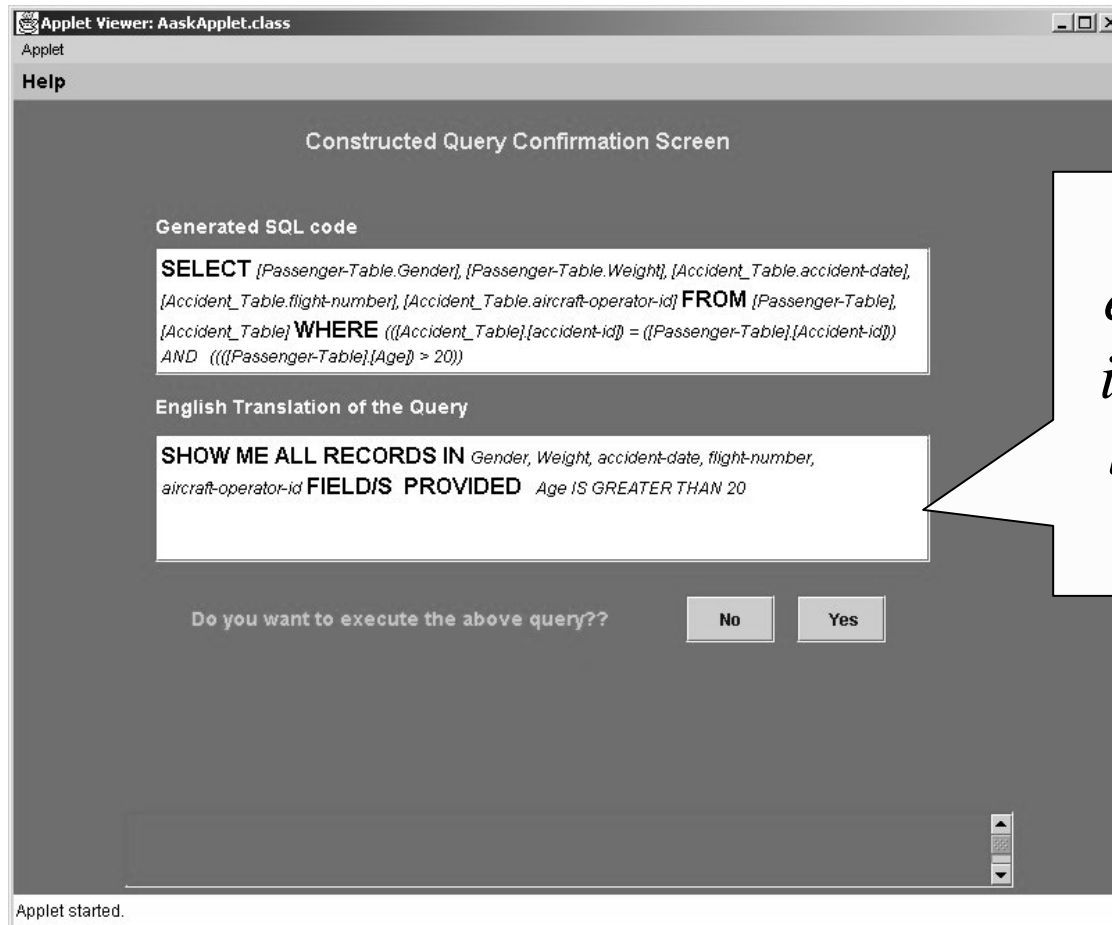
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AASK V4.0 : Query Facility-Component choice

Help

AASK Database Component Selection Screen

List of AASK Database Components

Accident
Accident & Passenger
Accident & Fatalities
Accident & Cabin Crew
All Components

Choice of components leading to faster queries

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AASK V4.0 : Query Facility- query builder with translation

Applet Viewer: AaskApplet.class

Applet

Help

Constructed Query Confirmation Screen

Generated SQL code

SELECT *[Passenger-Table.Gender], [Passenger-Table.Weight], [Accident_Table.accident-date], [Accident_Table.flight-number], [Accident_Table.aircraft-operator-id]* FROM *[Passenger-Table], [Accident_Table]* WHERE *(([Accident_Table].[accident-id]) = ([Passenger-Table].[Accident-id])) AND ((([Passenger-Table].[Age]) > 20))*

English Translation of the Query

SHOW ME ALL RECORDS IN *Gender, Weight, accident-date, flight-number, aircraft-operator-id* FIELD/S PROVIDED *Age IS GREATER THAN 20*

Do you want to execute the above query??   **No**   **Yes**

Applet started.

SQL explained in natural language

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AASK V4.0 : Query Facility- cut and paste to analysis package of choice

These results ready to copy to the local computer's clipboard

AASK V4.0 : Query Facility- support for aggregate functions

- **COUNT**: Counts the number of rows containing not null values for the given column.
- **SUM**: Outputs the sum of all values in a given column.
- **AVG**: Outputs the mean or average of a given column.
- **MIN**: Outputs the minimum value in a given column.
- **MAX**: Outputs the maximum value for a given column.

AASK V4.0 : 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**

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