CABIN WATER SPRAY SYSTEMS

The following is a first attempt at defining the requirements associated with these systems.

25.XXXX Cabin water spray (mist?) systems

(a) A cabin water spray system, required by the National Operating Rules, must meet the requirements of this paragraph.

(b) The cabin water spray system must, for the intended cabin configuration, meet the following test criteria ... when tested in accordance with Appendix X, or other approved equivalent method.

(c) The system must be operable manually from the flight crew station and from positions in the passenger compartment which allow operation from each normal flight attendant station.

(d) There must be a means to safeguard against inadvertent operation of the system.

(e) There must be an arming control device which is operable from the flight crew station. When the system is armed it may be operated at either the flight crew or flight attendant stations.

(f) The cabin water spray system must be capable of normal operation after having been subjected to the inertia forces listed in JAR 25.561(b).

(g) There must be a means to immediately deactivate the system which is operable at the flight crew and flight attendant stations.

(h) There must be an indication to the flight crew and flight attendants of whether the system is armed, off, or has been deactivated.

(i) The cabin water spray system must be designed so that it will not be rendered inoperative after any single transverse vertical separation of the fuselage during crash landing.

(j) Operation of the cabin water spray system must not delay an emergency evacuation or adversely affect the emergency evacuation assist means required by JAR 25.807 to 25.812 inclusive.

(k) The cabin water spray system must be capable of being activated in the event of the flight or cabin crew being unable to do so manually.

2. POTABLE WATER ONLY

Assumptions

(i) Insufficient potable water remaining at end of flight.

(ii) Otherwise, potable water provides 3 minute duration.

(iii) Modular system.

Accident No.	Lives Saved
10	1
19	9
24	8
26	1
36	7
38	4
69	11.5
70	1
71	6.5
74	35
78	3
79	0.75
80	4
84	7.5
87	6
15	105.25

Note:- If potable water only a tender system would have saved an additional 35 lives, but these in turn would have been saved by an appropriate dedicated on board system (see 3).

3. DEDICATED WATER

3.1 Assumptions

(i) A 1 minute supply effectively provides 45 seconds of additional protection.

(ii) Modular system.

(iii) Protection starts at beginning of accident.

(iv) No potable water.

(v) Evacuation time (or duration) required calculated by considering that time required for additional lives to leave aircraft at the same rate as those who did in actual accident.

Accidents with Evacuation Time, $t < 45$ seconds

	Accident No.	Lives Saved
	5	11
	6	7
	10	1
	13	2.5
	15	16
	19	9
	24	8
	26	1
	29	10
	36	7
	37	5
	38	4
	41	4.25
	49	0.5
	54	14
	70	1
	79	0.75
	84	7.5
	87	6
	89	21
Total	20	136.5

Accidents with Evacuation Time

Accident No.	Lives Saved
25	$\frac{45}{78} \times 9.75$
27	$\frac{45}{135} \times 88$
62	$\frac{45}{88} \times 11.25$
64	$\frac{45}{57} \times 5.5$
67	$\frac{45}{80} \times 9.5$
74	$\frac{45}{81} \times 35$
86	$\frac{45}{80} \times 45$
Total 7	95.2

Total lives saved with 1 minute duration = 231.7 in 27 accidents.

3.2 Assumptions

(i) A 2 minute supply effectively provides 90 seconds of additional protection.

(ii) Modular system.

(iii) Protection starts at beginning of accident.

(iv) No potable water.

(v) Evacuation time (or duration) required calculated by considering that time required for additional lives to leave aircraft at the same rate as those who did in actual accident.

Accidents with Evacuation Time, $45 < t < 90$ seconds

Accident No.	Lives Saved
25	9.75
62	11.25
64	5.5
67	9.5
74	35
86	45
Total 6	116

Accidents with Evacuation Time, t < 90 seconds

	Accident No.	Lives Saved
	27	$\frac{90}{135} \times 88$
Total	1	58.67

Total lives saved with 2 minute duration = 311.2 in 27 accidents.

3.3 Assumptions

(i) A 3 minute supply effectively provides 135 seconds of additional protection.

(ii) Modular system.

(iii) Protection starts at beginning of accident.

(iv) No potable water.

(v) Evacuation time (or duration) required calculated by considering that time required for additional lives to leave aircraft at the same rate as those who did in actual accident.

Accidents with Evacuation Time, 90 < t < 135 seconds

	Accident No.	Lives Saved
	27	88
Total	1	88

Total lives saved with 3 minute duration = 340.5 in 27 accidents.

3.4 Assumptions

(i) Repeat 3.1 to 3.3 but assume a "perfect" rather than modular system. The same accidents are considered with following results:-

3.4.1 "1 minute" spray saved 239.75 lives

3.4.2 "2 minute" spray saves 344.75 lives

3.4.3 "3 minute" spray saves 398.5 lives

3.4.4 "4 minute" spray saves 401.5 lives

4. EFFECT OF DYNAMICALLY TESTED SEATS

Reference: AM. 25-64 and FAA Cost Benefit Study DOT/FAA/CT-85/36 dated October 1986.

4.1 Accidents 1970 to 1983 where seat failure caused loss of life/injury.

	Accident No.	Fatalities	Injuries
	25	22	10
	30	0 to 29	0 to 4
	40	1	2
	42	0 to 23	0
	20	0	4
	41	4	0
Total	6	27 to 79	16 to 20

4.2 Assume seat effectiveness of 80%, as in Am. 25-64.

	Accident No.	Lives Saved	Injuries Prevented
	25	17.6	8
	30	0 to 23.2	0 to 3.2
	40	0.8	1.6
	42	0 to 18.4	3.2
	20	0	0
	41	3.2	
Total	6	21.6 to 63.2	16

5. EFFECT OF IMPROVED CABIN MATERIALS

Reference:- Am. 25-66

Assumed benefit is between 1988 to 2000 increasing at 3% per year from 0% to 36%. Based on assumption that 9 to 16 lives per year had potential to be saved this becomes a total of 21 to 37.5 lives between 1988 to 2000. This is a maximum of, on average, about 3 lives per year.

DESIGN REQUIREMENTS

The following issues have been selected from the comment document on the Consultative Conference. The criterion for selection is primarily a perceived system requirement which is not already covered by a requirement in the FAR/JAR codes. Interpretation of these requirements will be basis of an ACJ or equivalent.

(i) Requirements associated with fuselage break up.

(ii) Assessment of system performance in each cabin configuration.

(iii) Incorporation of arming feature for use by flight crew with indication to cabin crew.

(iv) Manual initiation means to be provided for cabin crew, zonal or entire cabin depending on aircraft. Inadvertent operation shall not be possible (ie cabin crew, pax etc).

(v) Automatic initiation for crew incapacitation, i.e. aircraft break up, so that system work in most adverse conditions (see (i)).

(vi) In case of inadvertent operation a means to immediately deactivate system available to both flight and cabin crews with appropriate indication.

(vii) Effect of system operation on emergency evacuation requirements.

(viii) Duration of system, specification of a time or more general such as to meet the performance requirements. Possible addition of a tender system.

NET SAFETY BENEFIT ANALYSIS

1. NO ON BOARD WATER

Assumptions

(i) No water on aircraft

(ii) Rescue services arrive before last person on aircraft succumbs to fire.

(iii) Rescue services have sufficient water to maintain supply indefinitely.

(iv) Previous safety measures are taken into account.

Accident No.	Lives Saved	A/C Type	Tender Location
10	1	B707	Fwd of wings.
54	14	DC-8	Port, fwd of tail. Aircraft not on undercarriage.
74	35	B737	Fwd of wings.
79	0.75	B727	Mid section.
89	21	B737	Right hand, fwd of wing.
Total - 5	71.75		

Note:- Except no. 79, all accidents would have had an intact CWSS.