

AIRCRAFT HUSH KITS

PROGRAM REVIEW & IMPACT ON AIRCRAFT VALUE

What, Why, Where and When ?



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Aircraft Hush Kits

What ?

- **“A Solution Driven Problem”**
 - technology becomes available regulations follow.
- **Hushkits first political second technical**
 1. means to meet arbitrary aircraft noise standards to please airport neighbors, environmentalists (and, coincidentally, aircraft manufacturers)
 2. relative to engine and airframe development:
 - lower technology (although very sophisticated)
 - lower capital investment
 - shorter development time frame (therefore, an entrepreneurial opportunity for non-aircraft manufacturers)

Aircraft Hushkits

..... Why ?

Regulation - no economic justification

- add cost
(capital, operating, maintenance)
- no financial benefit
(except when combined with performance enhancements)

“a political and social benefit”

Aircraft Hush Kits

.... Where and When ?

- **United States**

- Airport Noise and Capacity Act - Nov.1990 - Stage 2 non-addition
- Stage 3: Y/E 1994 = 25% 1996 = 50% 1998 = 75% 1999 = 100%

- **Europe**

- Chapter 2 non-addition April 1995
- Chapter 3 hushkit & <3:1 bypass ratio non-addition May 2000
- Chapter 3 compliance deadline April 2002

- **Rest of the World**

- Australia, Canada, Japan, New Zealand, Argentina, Colombia, Brazil, Mexico (proposed)

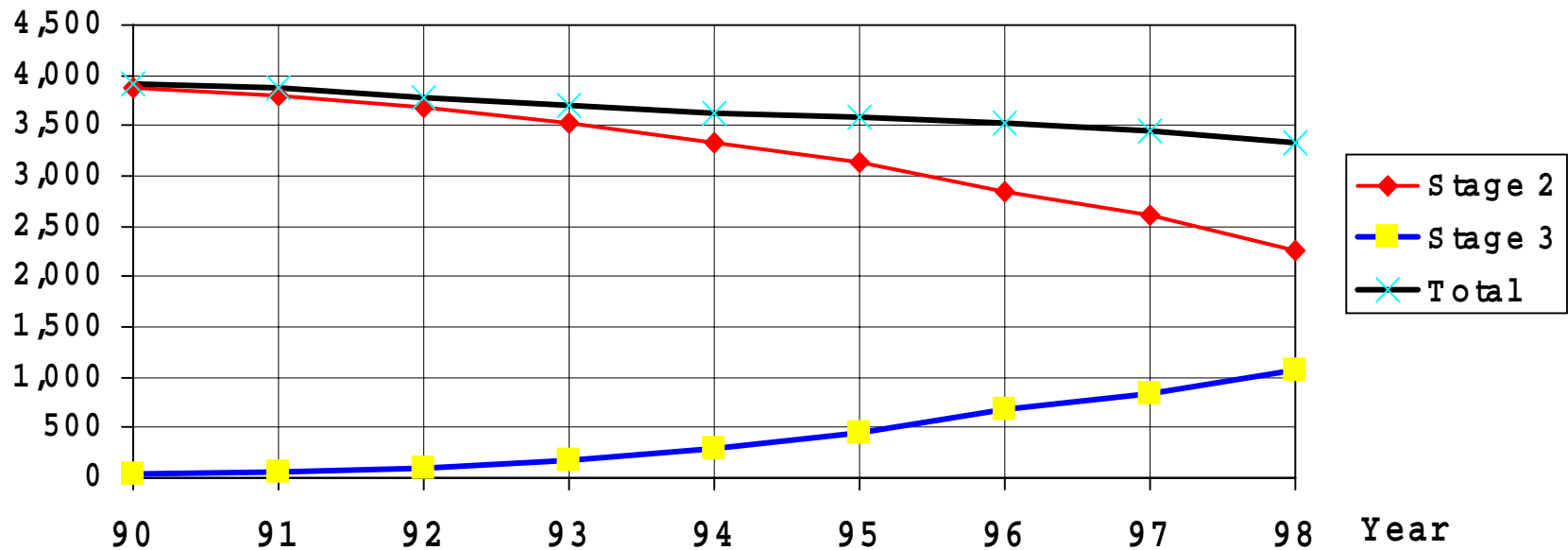
Aircraft Hush Kits Technology

- **U.S. Entrepreneurs - Technological Diversity**
 - replaced inlet guide vanes
 - engine exhaust ejector shrouds
 - extended tailpipes
 - ejector suppressor
 - flat rated engines
 - slotted flap droop
 - re-engining
 - sound absorbing linings
 - internal exhaust gas mixers
 - acoustical spacer cases
 - reduced flap settings
 - optimized leading edge flaps
 - winglets

Aircraft Fleet Hushkit Development

B 727, B 737, DC -8 and DC -9

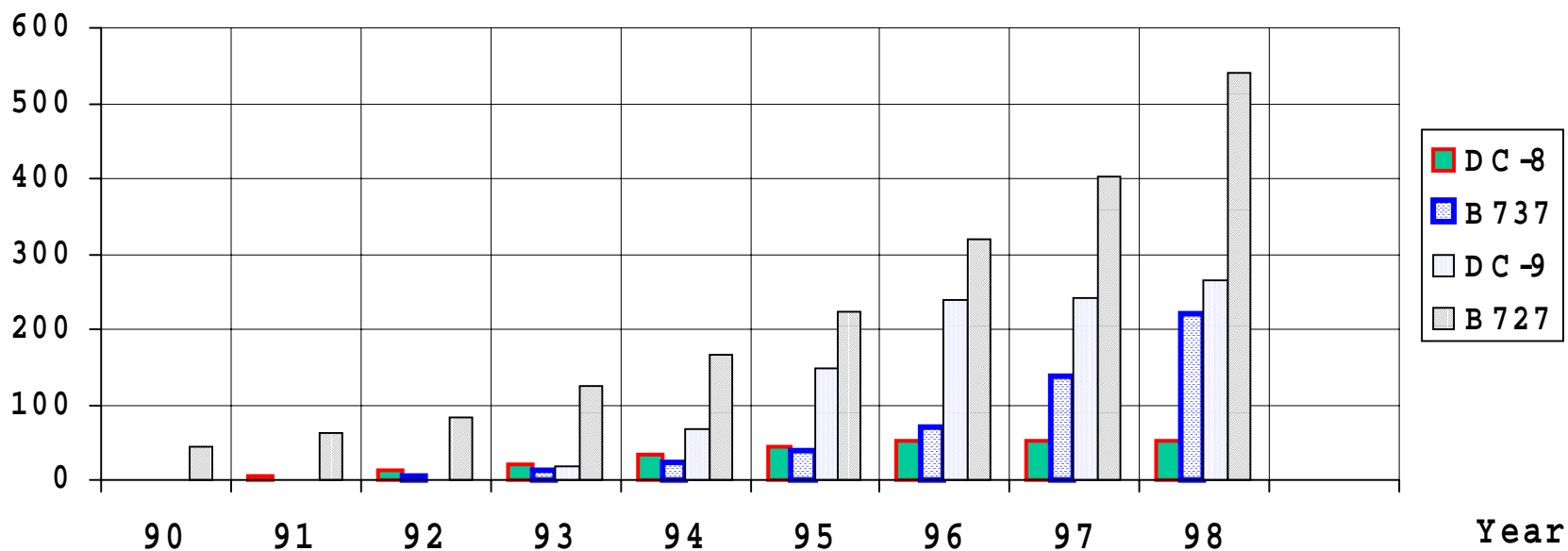
Aircraft



Aircraft Fleet Hushkit Development

B 727, B 737, DC -8 and DC -9

Aircraft



JT8D Engine Hushkit Status Y/E 1998

Aircraft	Active Aircraft	Firm Orders	Options	Total Orders & Options	Percent Active Fleet of Total
B727	1,294	641	170	429	63%
B737	975	365	152	180	53%
DC-9	823	404	47	328	55%



Hushkit Programs

Current Status

Aircraft	Vendor	STC Date	Orders	Delivered	Backlog	Options
B727	FEASI	1989 / 92	726	640	86	46
B727	Raisbeck	1998 / 99	107	73	34	23
B727	Duganair	1999	47	27	20	22
B737	Nordam	1990 / 96	348	277	71	128
B737	AvAero	1996	110	66	44	23
DC-9	ABS	1992 / 99	500	463	37	59
DC-8	Burbank	1990	94	87	7	0
		Totals	1,932	1,633	299	301

Hushkit Costs

List Prices ? - *Discounts Available*

Aircraft	Vendor	Orders	List Prices	
			Low Weight	High Weight
B727	FEASI	726	\$1.9	\$2.6
B727	Raisbeck	107	\$0.7	\$1.8
B727	Duganair	47	\$0.8	\$2.3
B737	Nordam	348	\$1.8	
B737	AvAero	110	\$1.2	
DC-9	ABS	500	\$1.4	\$2.1
DC-8	Burbank	94	\$3.0	
B707	Burbank	na	\$3.0	
B727	BF Goodrich	45	\$7 - \$8 (est. net cost)	

Hushkit Market Prospects

- B727 < 100 - 200
- B737 150 - 200
- DC-9 < 100
- DC-8 0
- B707 50 commercial x military

Cost v. Value

- Cost of hushkits vary.
- Cost of hushkits affect aircraft trading prices.
- Reducing noise *per se* does not increase revenues or reduce operating costs.
- The “extending economic life argument” is specious, as hushkits only return economic life to “normal.”
- Two comparable hushkits can cost a different amount.

So, what is the impact of hushkits on aircraft value?

Cost & Value Comparison

B737 Hushkit Aircraft

<p>Boeing 737-200A (-15) Manufactured: 1980 MGTOW: 120,000 lbs Mid time, Mid Life</p>	<p>Boeing 737-200A (-15) Manufactured: 1980 MGTOW: 120,000 lbs Mid time, Mid Life</p>
<p>FMV \$5.0 mil.</p> <p><u>Nordam Original Hushkit</u></p> <p>\$3.0 mil.</p> <p>Fuel Penalty 5%, 10 years</p> <p>PV @3% \$0.8 mil.</p> <p>Total Cost: \$8.8 mil.</p> <p>Value: \$?</p>	<p>FMV \$5.0 mil.</p> <p><u>Nordam Current Hushkit</u></p> <p>\$1.3 mil.</p> <p>Fuel Penalty n/a</p> <p>Total Cost: \$6.3 mil.</p> <p>Value: \$?</p>

Cost & Value Comparison

B727 Hushkit Aircraft

<p>Boeing 727-200A (-15) Manufactured: 1980 MGTOW: 192,000 lbs Mid time, Mid Life</p>		<p>Boeing 727-200A (-15) Manufactured: 1980 MGTOW: 192,000 lbs Mid time, Mid Life</p>	
<p>FMV \$4.0 mil.</p> <p><u>FEASI Hushkit</u></p> <p>\$2.6 mil.</p> <p>Total Cost: \$6.6 mil.</p> <p>Value: \$?</p>	<p>FMV \$4.0 mil.</p> <p><u>Dugan Hushkit</u> \$1.8 mil</p> <p>4% Fuel Saving PV (\$1.0) mil.</p> <p>Dugan Net Cost \$0.8 mil.</p> <p><u>Total Cost: \$4.8 mil.</u></p> <p><u>otal Cost: \$4.8 mil.</u></p> <p>aisbeck Hushkit \$1.3 mil.</p> <p><u>otal Cost: \$5.3 mil.</u></p> <p>alue: \$</p>		