

Fråga om certifieringsvärde

Transportstyrelsen har ombetts inkomma med ett yttrande gällande villkor 4 i Brommas tillstånd enligt miljöbalken. I ert brev ställer ni fyra frågor till oss, vilka vi besvarar nedan. Till grund för våra svar ligger följande dokument, som vi erhållit per e-post från Stockholms Stads miljöförvaltning:

- a) PM från Swedavia om Certifieringsvärden, daterad 2015-04-20
- b) Airport Information Sheet för Brussels Airlines gällande Bromma, utfärdad 2015-03-13
- c) Brev från British Aerospace till Braathens Malmö Aviation, daterat 1999-08-27, Ref no JFE.AC013/99, gällande Avro RJ100 Bullervärden.
- d) Flight operations Edition 8, sid 191 av 253, gällande operativa procedurer på Bromma, utfärdat av Malmö Aviation.

Dessutom har Transportstyrelsen erhållit följande tre handlingar från BAE systems, tillverkare av de aktuella flygplanstyperna.

- e) Bullermätresultat från British Aerospace, dokument ADE-EFE-C-463-AC0260 "AVRO 146-RJ100 with LF507-1F engines, compliance with BCAR Section N Noise and with FAR Part 36 Noise standards, Supplement No 3 to BAe 146 C of A Report No 137, Juni 1993.
- f) Brev från BAe systems till Malmö Aviation gällande Supplementary Data to Noise certification Data för AVRO RJ100, referens FOS/SM/37/2015, 1 juni 2015.
- g) Brev från BAe systems till Malmö Aviation gällande Supplementary Data to Noise certification Data för AVRO RJ85, referens FOS/SM/31A/2015, 1 juni 2015.

- 1) Bedömer Transportstyrelsen att de redovisade dokumenten visar att RJ100 kan framföras så att ljudemissionerna inte överstiger 89 EPNdB i medeltal för de tre certifieringsmätpunkterna?**

Transportstyrelsen konstaterar att dokument c) ovan bland annat visar att Storbritanniens luftfartsmyndighet har certifierat flygplanstypen Avro 146-RJ-100 försedd med fyra motorer av typen Lycoming LF 507-1F med maximal startvikt 44 225 kg och maximal landningsvikt 40 142 kg, enligt ICAO Annex 16 Vol I kapitel 3. Dokumentet anger att medelvärdet av certifieringsvärdena i de tre punkterna för ovan nämnda flygplan är 89 EPNdB, om hänsyn tas till:

- I. en glidbana på 3,5 grader (vilket motsvarar en halv grad brantare än standard certifieringsprocedur), ger enligt dokumentationen 1,7 EPNdB i förbättring i landningsmätpunkten
- II. Stängda luftbromsar, ger enligt dokumentationen 1,8 EPNdB i förbättring i landningsmätpunkten.
- III. Startprocedur med cut-back, ger enligt dokumentationen 4,7 EPNdB i förbättring i mätpunkten avseende start 6,5 km ut från pådragspunkten.

Gällande I) ovan, så flyger flygplanet högre över landningsmätpunkten när glidbanan höjs till 3,5 grader, jämfört med 3 grader. Denna avståndsskillnad ger upphov till en lägre ljudnivå, både på grund av ökad avståndsdämpning och ökad atmosfärsdämpning. I ICAO Annex 16 Vol I, Appendix 2, avsnitt 9, finns metoder angivna för att beräkna ljuddämpning orsakad av dessa effekter. Transportstyrelsen bedömer med hjälp av metoderna ovan att 1,7 EPNdB är en rimlig ljuddämpning som kan erhållas på grund av den höjda glidbanan. Vi har dock ingen möjlighet att bedöma rimligheten av ljudminskningen - i EPNdB - i II) och III) ovan, men Transportstyrelsen har ingen anledning att ifrågasätta en annan myndighets certifierade resultat, som vi bedömer vara tillförlitliga.

Det bör poängteras att ovanstående ljudnivåer avser angiven start- och landningsvikt i dokument c).

- 2) Har Transportstyrelsen tillgång till dokument som ytterligare visar ljudemissionerna vid det redovisade förfarandet vid**

**landning för RJ100 i medeltal för de tre certifieringspunkterna
som omnämns i villkoret?**

Dokument e), f) och g) ovan innehåller ytterligare information gällande bullermätningar och resultat för RJ100 respektive RJ85.

I dokument e) Appendix 1, stycke A1.2.1 redovisas de meteorologiska förutsättningar som angivna ljudnivåer avser. Dessa överensstämmer med ICAO Annex 16, Volym 1, kapitel 3, avsnitt 3.6.1.

3) Hur bedömer Transportstyrelsen risken för att flygplan i faktisk trafik framförs på ett annat sätt än vad som anges i Operation Manuals?

Transportstyrelsen genomför årligen sju tillsynsaktiviteter per flygbolag med Svenskt AOC.

Vi flyger med en besättning på bolaget en eller flera gånger per år för att bekräfta att samtliga beskrivna procedurer följs i den dagliga verksamheten.

Vi inspekterar utbildning och kontroll i både simulator och klassrum. Vi följer flygbolagsledningens arbete via audits av hela ledningsverksamheten.

Flygbolaget har en skyldighet att rapportera samtliga avvikelser från publicerade procedurer som sker inom verksamheten. Transportstyrelsen tar del av denna rapportering.

Avvikelser från de procedurer som är publicerade, tränade och kontrollerade förekommer väldigt sällan.

Transportstyrelsen bedömer risken för att flygplan i faktisk trafik avviker från publicerade procedurer i Operation Manuals som väldigt liten.

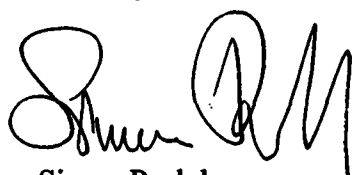
4) Övriga upplysningar som Transportstyrelsen vill anföra i ärendet?

I bilaga 1 till detta yttrande redovisar vi det antal rörelser av de olika RJ100-individer respektive RJ85-individersom flugit på Bromma från år 2009 till och med år 2014, och som finns registrerade i Transportstyrelsens rörelseregister. Varje individ har en registreringsbeteckning. Om denna börjar med SE är flygplanet registrerat på svenskt luftfartygsregister. Miljövårdighetsbevis för de RJ100 och RJ85 som är svenskregistrerade återfinns i bilaga 2. Önskas miljövårdighetsbevis för utländskt registrerade luftfartyg kan luftfartsmyndighet i aktuell stat kontaktas.

Transportstyrelsen vill också erinra om Europaparlamentets och rådets förordning (EG) nr 1008/2008 av den 24 september 2008 om gemensamma regler för tillhandahållande av lufttrafik inom gemenskapen vilken kan ha bäring på detta fall. Artikel 19 i denna förordning stadgar fördelning av trafik mellan flygplatser och utövande av trafikrättigheter. I artikel 20 finns miljöåtgärder.

Även annan reglering kan vara värd att uppmärksamma i detta sammanhang. Bestämmelser om bullerrestriktioner finns i Europaparlamentet och rådets förordning 598/2014/EU, (som upphäver direktiv 2002/30/EG). I förordningen finns regler och förfaranden för att av bullerskäl införa driftsrestriktioner vid flygplatser i unionen. Möjligheten till restriktioner finns vad gäller de mest bullrande flygplanstyperna så kallade "marginally compliant aircraft". RJ100 bullrar betydligt mindre än sådana flygplanstyper. I artikel 14 i förordningen sägs att restriktioner som introducerats före förordningens tillkomst kan fortsätta gälla, till dess att behörig myndighet (som ej är utpekad i Sverige ännu) väljer att ändra restriktionerna.

Yttrandet har beslutats av Simon Posluk. I beredningen av yttrandet har deltagit avdelningsdirektör Ingrid Cherfils, sektionschef Anna Petersson, flygoperativ inspektör Lars Kristiansson, sektionschef Lars Haglund, jurist Anna-Pia Johansson och sakkunnig miljö Marie Hankanen, den senare föredragande.



Simon Posluk
Enhetschef

Bilaga 1: Antal rörelser på Bromma flygplats med flygplantyperna RJ100 respektive RJ85 under åren 2009-2014, källa: Transportstyrelsens rörelseregister

Luftfartyg - Re	Flygplanstyp	2009	2010	2011	2012	2013	2014
SEDSO	RJ100	1 712	1 584	1 762	1 424	1 574	1 766
SEDSY	RJ100	1 576	1 384	1 539	1 452	1 436	1 622
SEDSX	RJ100	1 536	1 460	1 543	1 589	1 505	1 609
SEDSR	RJ100	1 599	1 551	1 584	1 517	1 559	1 586
SEDSP	RJ100	1 553	1 329	1 532	1 765	1 593	1 523
SEDSS	RJ100	1 571	1 387	1 578	1 619	1 556	1 497
SEDSV	RJ100	1 307	1 476	1 548	1 502	1 495	1 496
SEDST	RJ100	1 353	1 476	1 490	1 584	1 491	1 462
SEDSU	RJ100	1 408	1 488	1 644	1 640	1 390	1 363
SEDJN	RJ85	732	1 010	986	1 033	1 091	1 213
SEDJO	RJ85	267	814	966	1 057	1 121	972
SERJI	RJ100	0	0	0	0	0	488
OODWK	RJ100	92	120	130	193	194	229
OODWL	RJ100	92	122	128	166	176	205
OODWJ	RJ100	104	112	133	215	158	204
SEDJR *	RJ85	0	0	0	296	630	199
OODWI	RJ100	122	76	144	124	171	197
OODWD	RJ100	128	100	133	133	110	146
OODWE	RJ100	84	78	136	141	152	140
OODWG	RJ100	110	62	148	132	122	138
OODWC	RJ100	110	94	125	126	114	132
OODWB	RJ100	106	98	94	138	142	130
OODWF	RJ100	90	104	128	132	148	126
OODWH	RJ100	78	114	102	116	138	118
OODWA	RJ100	138	94	130	113	116	106
OYRCC	RJ100	0	0	0	54	10	66
OODJP	RJ85	56	78	40	53	40	64
EIRJA	RJ85	0	0	0	0	2	0
OYRCE	RJ85	0	0	0	4	0	0
OYRCD	RJ85	0	4	0	0	0	0
OODJK	RJ85	50	66	4	0	0	0
OODJQ	RJ85	78	86	24	0	0	0
OODJL	RJ85	50	52	24	0	0	0
OODJN	RJ85	46	74	38	0	0	0
OODJO	RJ85	54	80	40	0	0	0
OODJV	RJ85	46	62	46	12	0	0
OODJT	RJ85	50	78	48	6	0	0
OODJR	RJ85	48	32	50	10	0	0
OODJW	RJ85	72	72	50	27	0	0
OODJS	RJ85	68	82	56	0	0	0
OODJX	RJ85	58	72	56	73	0	0
OODJY	RJ85	68	62	62	56	0	0
OODJZ	RJ85	38	70	66	63	0	0

* Exporterad 2014

Bilaga 2:11



Swedish Transport Agency

2. MILJÖVÄRDIGHETSBEVIS (NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) DJN2012072745
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DJN	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO-146-RJ85
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E2231	
7. Motor (Engine) Lycoming LF507-1F	8. Propeller (*) N/A
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 43995	10. Maximal landningsmassa (kg) (*) (Maximum landing Mass) 38565
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införs för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None	
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,4 EPNdB	14. Bullernivå vid inflygning (*) (Approach Noise Level) 87,3 EPNdB
15. Bullernivå under släpsten (*) (Flyover Noise Level) 84,3 EPNdB	16. Bullernivå vid planflykt (*) (Circuit Noise Level) N/A
17. Bullernivå vid start (*) (Take-Off Noise Level) N/A	
Anmärkningar (Remarks) None	
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 216/2008, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 216/2008, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)	
19. Datum för utfärdande (Date of issue): 27 Jul 2012	20. Underskrift (Signature): ASDB Approved Transportstyrelsen EASA Form 45

Detta miljövärdebevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard).



Swedish Transport Agency

2. MILJÖVÄRDIGHETSBEVIS (NOISE CERTIFICATE)

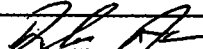
1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) DJO2012072745
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DJO	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO-146-RJ85
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E2236	
7. Motor (Engine) Lycoming LF507-1F	8. Propeller (*) N/A
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 43995	10. Maximal landningsmassa (kg) (*) (Maximum landing Mass) 38565
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införs för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None	
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,4 EPNdB	14. Bullernivå vid inflygning (*) (Approach Noise Level) 87,3 EPNdB
15. Bullernivå under släpsten (*) (Flyover Noise Level) 84,3 EPNdB	16. Bullernivå vid planflykt (*) (Circuit Noise Level) N/A
17. Bullernivå vid start (*) (Take-Off Noise Level) N/A	
Anmärkningar (Remarks) None	
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 216/2008, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 216/2008, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)	
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Detta miljövärdebevis skall medföras ombord under alla flygningar.
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2. MILJÖVÄRDIGHETSBEVIS (BULLER)
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00260	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSO		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3221		7. Motor (Engines) Lycoming ALF507-1F	
8. Propeller (*) N/A		9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225	
10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 39 235		11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå, närmaning (*) (Approach Noise Level) 97,4 EPNdB	15. Bullernivå, start/slagfäsen (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovan nämnda luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-04-16		20. Underskrift (Signature): 	

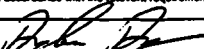
Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

 **Anders Andersson**
Inspector
Certification

EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandard (These boxes may be omitted depending on noise certification standard)

2. MILJÖVÄRDIGHETSBEVIS (BULLER)
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00122	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSP		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3242		7. Motor (Engines) Lycoming ALF507-1F	
8. Propeller (*) N/A		9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225	
10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142		11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå, närmaning (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå, start/slagfäsen (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovan nämnda luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19		20. Underskrift (Signature): 	

Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

 **Anders Andersson**
Inspector
Certification

EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandard (These boxes may be omitted depending on noise certification standard)

Bilaga 2(2)

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Bilaga 2(3)



LUFTFARTSSTYRELSEN
Swedish Civil Aviation Authority

2. MILJÖVÄRDIGHETSBEVIS (BULLER)
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00196	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSR		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3244			
7. Motor (Engine) Lycoming ALF507-1F		8. Propeller (*) N/A	
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225		10. Maximal landningsmassa (kg) (*) (Maximum landing Mass) 40 142	
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume 1, Chapter 3			
12. Ytterligare ändringar som införas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid inflygning (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå vid start/bjergfärd (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19		20. Underskrift (Signature):	

Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Anders Andersson
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandard (These boxes may be omitted depending on noise certification standard).



LUFTFARTSSTYRELSEN
Swedish Civil Aviation Authority

2. MILJÖVÄRDIGHETSBEVIS (BULLER)
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00196	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSS		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3245			
7. Motor (Engine) Lycoming ALF507-1F		8. Propeller (*) N/A	
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225		10. Maximal landningsmassa (kg) (*) (Maximum landing Mass) 40 142	
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume 1, Chapter 3			
12. Ytterligare ändringar som införas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid inflygning (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå vid start/bjergfärd (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19		20. Underskrift (Signature):	

Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Anders Andersson
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandard (These boxes may be omitted depending on noise certification standard).

Bilaga 2(4)



2. MILJÖVÄRDIGHETSBEVIS (BULLER) (NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) MVB-00200
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DST	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3247	
7. Motor (Engine) Lycoming ALF507-1F	8. Propeller (*) N/A
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225	10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införlivas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None	
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid anslutning (*) (Approach Noise Level) 97,6 EPNdB
15. Bullernivå under stigning (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB	
Anmärkningar (Remarks)	
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullermöten då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)	
19. Datum för utfärdande (Date of issue): 2008-03-19	20. Underskrift (Signature):

19. Detta miljövärdebevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Anders Andersson
Inspektör
Luftfartyg
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard)



2. MILJÖVÄRDIGHETSBEVIS (BULLER) (NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) MVB-00197
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSU	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3248	
7. Motor (Engine) Lycoming ALF507-1F	8. Propeller (*) N/A
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225	10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införlivas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None	
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid anslutning (*) (Approach Noise Level) 97,6 EPNdB
15. Bullernivå under stigning (*) (Flyover Noise Level) 88,2 EPNdB	16. Bullernivå vid planflykt (*) (Overflight Noise Level) 88,2 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 88,2 EPNdB	
Anmärkningar (Remarks)	
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullermöten då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)	
19. Datum för utfärdande (Date of issue): 2008-03-19	20. Underskrift (Signature):

19. Detta miljövärdebevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Anders Andersson
Inspektör
Luftfartyg
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard)

Bilaga 2(5)



2. MILJÖVÄRDIGHETSBEVIS (BULLER) (NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00201	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSV		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3250			
7. Motor (Engins) Lycoming ALF507-1F		8. Propeller (*) N/A	
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225		10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142	
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3			
12. Ytterligare ändringar som införlivas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid införing (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå vid start/stigfärd (*) (Fly/Climb Noise Level) 84,5 EPNdB	16. Bullernivå vid planflykt (*) (Cruise Noise Level) 84,5 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 84,5 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1582/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1582/2002, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19		20. Underskrift (Signature):	

1619-01 Detta miljövärdebevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Peter Andersson
Regeringen
LUFTFARTSSTYRELSEN
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard).



2. MILJÖVÄRDIGHETSBEVIS (BULLER) (NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN		3. Dokumentnummer (Document No) MVB-00195	
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSX		5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	
6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3255			
7. Motor (Engins) Lycoming ALF507-1F		8. Propeller (*) N/A	
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225		10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142	
11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3			
12. Ytterligare ändringar som införlivas för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå vid införing (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå vid start/stigfärd (*) (Fly/Climb Noise Level) 84,5 EPNdB	16. Bullernivå vid planflykt (*) (Cruise Noise Level) 84,5 EPNdB
17. Bullernivå vid start (*) (Take-Off Noise Level) 84,5 EPNdB			
Anmärkningar (Remarks)			
18. Detta miljövärdebevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1582/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1582/2002, Article 6 in respect of the abovementioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19		20. Underskrift (Signature):	

1619-01 Detta miljövärdebevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights)

Peter Andersson
Regeringen
LUFTFARTSSTYRELSEN
EASA Form 45

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard).

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Bilag 2/6



2. MILJÖVÄRDIGHETSBEVIS (BULLER)
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) MVB-00202		
4. Nationalitet och registreringsbeteckning (Registration marks) SE-DSY	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO 146 Series RJ100	6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3263	
7. Motor (Engine) Lycoming ALF507-1F	8. Propeller (*) N/A		
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 44 225	10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40 142	11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införts för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,2 EPNdB	14. Bullernivå, närmaning (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå, start/björp (*) (Flyover Noise Level) 84,1 EPNdB	
16. Bullernivå vid planflykt (*) (Cruise Noise Level) N/A			17. Bullernivå vid start (*) (Take-Off Noise Level) N/A
Anmärkningar (Remarks) EASA Record Number: A18849			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 1592/2002, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 1592/2002, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 2008-03-19	20. Underskrift (Signature):		

Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights.)

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard).



2. MILJÖVÄRDIGHETSBEVIS
(NOISE CERTIFICATE)

1. Registreringsstat (State of registry) SWEDEN	3. Dokumentnummer (Document No) RJ2014882645		
4. Nationalitet och registreringsbeteckning (Registration marks) SE-RJI	5. Tillverkare och tillverkarens typbeteckning av luftfartyget (Manufacturer and Manufacturer's Designation of Aircraft) British Aerospace AVRO-146-RJ100	6. Luftfartygets tillverkningsnummer (Aircraft Serial Number) E3357	
7. Motor (Engine) Lycoming LF507-1F	8. Propeller (*) N/A		
9. Maximal startmassa (kg) (Maximum Take-Off Mass) 46000	10. Maximal landningsmassa (kg) (*) (Maximum Landing Mass) 40142	11. Bullercertifieringsstandard (Noise certification standard) ICAO Annex 16, Volume I, Chapter 3	
12. Ytterligare ändringar som införts för att uppfylla de tillämpliga bullercertifieringsstandarderna (Additional modifications incorporated for the purpose of compliance with the applicable noise certification standards) None			
13. Bullernivå, lateral/vid full effekt (*) (Lateral/Full-Power Noise Level) 88,1 EPNdB	14. Bullernivå, närmaning (*) (Approach Noise Level) 97,6 EPNdB	15. Bullernivå under björpen (*) (Flyover Noise Level) 84,1 EPNdB	
16. Bullernivå vid planflykt (*) (Cruise Noise Level) N/A			17. Bullernivå vid start (*) (Take-Off Noise Level) N/A
Anmärkningar (Remarks) EASA Record Number: A18849			
18. Detta miljövärldighetsbevis (buller) är utfärdat i enlighet med bilaga 16, volym I till konventionen om internationell civil luftfart av den 7 december 1944 och artikel 6 i förordning (EG) nr 216/2008, avseende ovanstående luftfartyg, som anses uppfylla den angivna bullernormen då de underhålls och drivs i enlighet med de relevanta kraven och operativa begränsningarna. (This Noise Certificate is issued pursuant to Annex 16, Volume I to the Convention on International Civil Aviation dated 7 December 1944 and Regulation (EC) No 216/2008, Article 6 in respect of the above-mentioned aircraft, which is considered to comply with the indicated noise standard when maintained and operated in accordance with the relevant requirements and operating limitations.)			
19. Datum för utfärdande (Date of issue): 26 Aug 2014	20. Underskrift (Signature):		

Detta miljövärldighetsbevis skall medföras ombord under alla flygningar.
(This permit shall be carried on board during all flights.)

(*) Dessa fält får utelämnas beroende på bullercertifieringsstandarden (These boxes may be omitted depending on noise certification standard).

Dok e)

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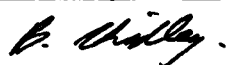
**AVRO 146-RJ100
with
LF507-1F ENGINES**

**CO PLIANCE WITH
CAR SECTION N NOISE
and with
FAR PART 36 NOISE STANDARDS**

**SUPPLEMENT No. 3
to
BAe 146 C of A REPORT No. 137**

June 1993

**BRITISH AEROSPACE - REGIONAL AIRCRAFT LIMITED
Woodford, Cheshire SK7 1QR, ENGLAND**

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<u>AVRO 146-RJ100</u> <u>WITH</u> <u>LF507-1F ENGINES</u> <u>COMPLIANCE WITH</u> <u>BCAR SECTION N NOISE AND WITH</u> <u>FAR PART 36 NOISE STANDARDS</u> <u>SUPPLE</u> No 3 <u>TO</u> <u>BAe 146 C OF A REPORT No 137</u>			
CIRCULATION Mr P R Kearsey (CAA) Mr P Blagden * (CAA) FAA Brussels (via CAA) FAA North West Region (via CAA) Mr T H Scott-Wilson * Mr B H Brasier * Mr D M Gibbons Mr A A McDicken * Mr B Beaman * Mr M R Schofield* Mr M E Thomas Mr M J Green * Mr R E C de Mercado * Mr R Scaife Mr E C Panter * Mr B Chidley * denotes Summary only			
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AVRO 146-RJ100 WITH LF507-1F ENGINES
COMPLIANCE WITH BCAR SECTION N NOISE AND WITH
FAR PART 36 NOISE STANDARDS

SUMMARY

This report is the third supplement to the BAe 146 Certification of Airworthiness Report No 137. It presents sideline, take-off and approach noise levels for the AVRO 146-RJ100 regional jet aircraft in order to demonstrate compliance with the noise requirements of BCAR Section N and FAR Part 36. The five maximum take-off and landing weight development phases of this aircraft are covered up to Phase 4, ie a MTOW of 101500 lb and a MLW of 88500 lb.

The AVRO 146-RJ100 is a development of the BAe 146 Series 300 and is powered by Textron LF507-1F engines. From a noise certification standpoint, this aircraft variant differs from the BAe 146 Series 300 with LF507 engines of the original noise submission, only, with respect to the Aircraft Flight Manuals standards of full-power take-off climb performance. The AVRO 146-RJ100 has a nominal 4% improved take-off climb gradient with a 2.3% increase in engine net thrust compared with the conservative standard of the BAe 146 Series 300. The approach certification cases are unaffected.

The AVRO 146-RJ100 certification noise levels have been calculated from the CAA and FAA approved noise databases. These were derived from measurements on a BAe 146 Series 300 aircraft and presented in C of A Report No 137. The differences in full power take-off performance have been accounted for by using the reference flight profiles derived for the AVRO 146-RJ100 in conjunction with the BAe 146 Series 300 noise databases. These adequately cover the AVRO 146-RJ100 thrust requirements for the range of take-off weights considered. The flight profiles are based on the same performance standards as those used in the derivation of the Aircraft Flight Manual.

The tables presented below compare the corrected noise levels at the maximum take-off and landing weights, for which certification is required, with the limits of BCAR Section N, Issue 5, Chapter N3-1,3 and with those of Stage 3 in Appendix C to FAR Part 36 (at Amendment 36-18 standard). Noise levels for the take-off position are shown both with and without the use of the permitted cutback procedure. For noise certification purposes the case to be considered is with cutback. In each table, approach noise certification levels are shown for the four landing configurations scheduled in the Flight Manual viz 33 deg and 24 deg landing flap settings, each with the airbrakes 'open' and 'closed'. In these tables, the 33 deg flap setting with the airbrakes 'open' is the noisiest configuration and therefore the one to be considered for noise certification.

The noise levels not required for noise certification have been retained in this report for validation by the certifying authorities, so that they may be included as supplementary data in the Aircraft Flight Manual.

PHASE 1 OF WEIGHT DEVELOPMENT

Maximum take-off weight lb (kg) 95000 (43091)
Maximum landing weight lb (kg) 83000 (37648)

POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	AVRO 146-RJ100 CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.8	88.3	+0.3
TAKE-OFF			
i) No cutback	93.4	88.8	+0.2
ii) With cutback	93.4	83.8	+0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.7	97.2	+0.2
airbrake CLOSED	98.7	95.6	+0.2
ii) 24 deg flap:			
airbrake OPEN	98.7	94.6	+0.2
airbrake CLOSED	98.7	93.2	+0.2

PHASE 2 OF WEIGHT DEVELOPMENT

Maximum take-off weight lb (kg) 97500 (44225)
Maximum landing weight lb (kg) 84500 (38328)

POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	AVRO 146-RJ100 CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.2	+0.3
TAKE-OFF			
i) No cutback	93.5	89.4	+0.2
ii) With cutback	93.5	84.7	+0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.8	97.3	+0.2
airbrake CLOSED	98.8	95.7	+0.2
ii) 24 deg flap:			
airbrake OPEN	98.8	94.6	+0.2
airbrake CLOSED	98.8	93.2	+0.2

PHASE 3 OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 97500 (44225) Maximum landing weight lb (kg) 86500 (39235)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	AVRO 146-RJ100 CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.2	± 0.3
TAKE-OFF			
i) No cutback	93.5	89.4	± 0.2
ii) With cutback	93.5	84.7	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.8	97.4	± 0.2
airbrake CLOSED	98.8	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.8	94.7	± 0.2
airbrake CLOSED	98.8	93.2	± 0.2

PHASE 3 (OPTIONAL) OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 99500 (45132) Maximum landing weight lb (kg) 86500 (39235)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	AVRO 146-RJ100 CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.1	± 0.3
TAKE-OFF			
i) No cutback	93.6	89.8	± 0.2
ii) With cutback	93.6	85.4	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.9	97.4	± 0.2
airbrake CLOSED	98.9	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.9	94.7	± 0.2
airbrake CLOSED	98.9	93.2	± 0.2

PHASE 4 OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 101500 (46039) Maximum landing weight lb (kg) 88500 (40142)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	AVRO 146-RJ100 CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	95.0	88.1	± 0.3
TAKE-OFF			
i) No cutback	93.7	90.3	± 0.2
ii) With cutback	93.7	86.1	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.9	97.6	± 0.2
airbrake CLOSED	98.9	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.9	94.7	± 0.2
airbrake CLOSED	98.9	93.2	± 0.2

It can be concluded from the data presented above that, for each of the combinations of maximum take-off and landing weights considered, the sideline, take-off and approach certification levels are less than the appropriate noise limits prescribed in both BCAR Section N and FAR Part 36. Also, the 90% confidence intervals quoted above are well below the prescribed limit of ± 1.5 EPNdB (typically ± 0.2 EPNdB).

Compliance of the AVRO 146-RJ100 aircraft powered by LP507-1F engines is therefore demonstrated with the noise type certification requirements of BCAR Section N and FAR Part 36. The maximum take-off and landing weights specified in the Aircraft Flight Manual will determine the certification noise levels applicable to an individual aircraft.

'A' weighted noise levels are included in this report for validation by the certifying authorities. These levels have been derived to the same standard of analysis as prescribed for the certification EPNL values.

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AVRO 146-RJ100 WITH LF507-1P ENGINES

COMPLIANCE WITH BCAR SECTION N NOISE AND WITH

FAR PART 36 NOISE STANDARDS

1 INTRODUCTION

The Certification of Airworthiness Report No 137 (Reference 1) demonstrated that the BAE 146 Series 300 aircraft powered by Textron LF507-1P (or 1H) engines complied with the noise limits of BCAR Section N Issue 5, Chapter N3-1, 3 (Reference 2) and with the identical Stage 3 limits in Appendix C to FAR Part 36 (Reference 3). Noise certification is now required for the AVRO 146-RJ100 aircraft.

The AVRO 146-RJ100, hereinafter referred to as the RJ100, is a development of the BAE 146 Series 300 test aircraft of Reference 1, hereinafter referred to as the Series 300. The source noise characteristics of these two aircraft types are identical, both being powered by Textron LF507 engines. However, their respective Aircraft Flight Manuals' (AFM) performance standards reflect a small improvement in the full power take-off climb performance of the RJ100 over that of the Series 300. It is this difference that has necessitated a revision to the sideline and take-off noise certification levels originally presented in Reference 1. The approach noise certification levels remain unchanged.

This report, which is the third supplement to Reference 1, is written in terms of the dual standards of BCAR Section N and FAR Part 36. It shows how the measured noise databases from the Series 300 trials have been used to demonstrate that the RJ100 aircraft powered by LF507-1P engines complies with the appropriate noise limits of these standards.

Maximum Take-Off Weights (MTOW) and Landing Weights (MLW) are covered up to the Phase 4 weight development limits as detailed below:

AIRCRAFT WEIGHT DEVELOPMENT	MTOW lb (kg)	MLW lb (kg)
PHASE 1	95000 (43091)	83000 (37648)
PHASE 2	97500 (44225)	84500 (38328)
PHASE 3	97500 (44225)	86500 (39235)
PHASE 3 (OPTIONAL)	99500 (45132)	86500 (39235)
PHASE 4	101500 (46039)	88500 (40142)

2 AIRCRAFT DEFINITION

The RJ100 is a four-engined, high wing subsonic regional jet aircraft seating 100 passengers in a 5 abreast layout. It is a development of the Series 300, providing Category IIIA All-Weather Landing

capability, improved avionic systems, and is powered by the Full Authority Digital Engine Control (FADEC) variant of the Textron LF507 engine, designated the LF507-1F. (The Hydromechanical mechanical variant, designated the LF507-1H, was only available on the Series 300). A general arrangement of the aircraft is shown in Figure 1 with relevant information presented in Table 1.

From a noise certification standpoint, the RJ100 differs from the Series 300 solely in respect to the standard of full-power take-off climb performance. The source noise characteristics of these two aircraft types are identical.

The Series 300 take-off performance standard used for the noise submission was compatible with that used to produce the Series 300 AFM, which was based on a conservative thrust level. An improved performance standard has been used in the preparation of the RJ100 AFM, taking full credit for thrust levels now demonstrated as being available.

The differences in take-off climb gradient and engine net thrust are shown in the table below covering the range of maximum take-off weights under consideration.

MTOW (lb)	HEIGHT (ft)	CLIMB GRADIENT* (%)		RJ100 PERCENTAGE IMPROVEMENT	THRUST (lb/ENG)		RJ100 PERCENTAGE IMPROVEMENT
		S.300	RJ100		S.300	RJ100	
101500	400	-	-	-	5135	5256	2.4
	1000	11.91	12.38	4.0	5044	5158	2.3
	1500	11.57	12.02	3.9	4967	5075	2.2
	2000	11.27	11.69	3.7	4891	4993	2.1
	3000	10.83	11.22	3.6	4747	4835	1.9
95000	400	-	-	-	5167	5294	2.5
	1000	13.49	14.03	4.0	5075	5195	2.4
	1500	13.13	13.63	3.8	4998	5112	2.3
	2000	12.80	13.28	3.8	4922	5030	2.2
	3000	12.32	12.76	3.6	4777	4871	2.0

* climb gradients calculated between successive height, ie at 1000 ft, gradient is between 400 ft and 1000 ft, etc.

The effect of these differences on the sideline and take-off noise certification levels are accounted for using the procedures described in Section 3 and Appendices 2 and 3.

3

DERIVATION OF CERTIFICATION NOISE LEVELS

In the Series 300 noise submission, the take-off and approach noise levels were derived from Noise Power Distance (NPD) databases in accordance with the equivalent procedures prescribed in the noise certification guidance material of References 4 and 5. The peak sideline level was derived from a sideline noise database corrected in accordance with reference aircraft take-off conditions as described in Reference 1, Section 6.2.

The CAA and FAA approved Series 300 noise databases have been used in conjunction with the RJ100 reference take-off profiles to derive the RJ100 sideline and take-off noise certification levels. This method of demonstrating compliance is valid by virtue of the RJ100 having the same noise characteristics as the Series 300. The engine thrust requirements for the various weight cases considered are within the range of thrusts used in deriving the Series 300 databases.

The derivation of the RJ100 reference take-off flight profiles for each of the maximum take-off weights under consideration is described in Appendix 1. The procedure for calculating the corresponding sideline and take-off noise certification levels, using these profiles with the Series 300 noise databases, are described in Appendices 2 and 3 respectively.

For the approach certification cases, the maximum landing weights and performance standards for the two aircraft variants are identical. This being the case there will be no change to the reference approach profiles presented in Reference 1, Appendix 1 (reproduced in Appendix 1 of this report). Consequentially, the approach noise certification levels for the RJ100 will be the same as those presented in Reference 1 for the Series 300.

4

COMPLIANCE WITH BCAR SECTION N AND WITH FAR PART 36

The fully corrected sideline and take-off noise levels derived in Appendices 2 and 3 and the approach noise levels quoted in Reference 1 are presented in Tables 2(a) to 2(f) for the maximum take-off and landing weights for which certification is required. These levels are compared with the noise levels prescribed in BCAR Section N, Issue 5, Chapter N3-1, 3 and with the identical Stage 3 noise limits in Appendix C to FAR Part 36 (at Amendment 36-18 standard).

In each of these tables the take-off is quoted with and without cutback, and the approach with the four landing configurations scheduled in the Flight Manual (viz 33 deg and 24 deg landing flap settings each with the airbrakes 'open' and 'closed'). For noise certification purposes, the take-off case to be considered is with cutback, and for the approach 33 deg flaps with airbrakes 'open' (noisiest configuration).

The noise levels not required for type certification have been included for validation by the certifying authorities so that they may be presented as supplementary data in the Aircraft Flight Manual.

The variation of sideline, take-off and approach noise levels with aircraft weight is summarised in Figure 2. This information is also included in the Aircraft Flight Manual, with aircraft weight specified in lb or kg units as appropriate.

It can be concluded from the comparisons given above that, the sideline, take-off and approach certification noise levels are less than the limits prescribed in either BCAR Section N or FAR Part 36.

Compliance of the RJ100 powered by LF507-1F engines is therefore demonstrated with the noise certification requirements of BCAR Section N and of FAR Part 36. The maximum take-off and landing weights specified in the Aircraft Flight Manual will determine the certification noise levels applicable to an individual aircraft.

5 NOISE LEVELS IN AN ALTERNATIVE METRIC

The FAA require noise levels in 'A' weighted decibels under certification conditions for publication in their Advisory Circular AC36.3. Therefore, the 'A' weighted noise levels of the RJ100 are presented in Appendix 4 for validation by the certifying authorities. These levels have been derived from the take-off and approach NPD charts presented in Reference 1, Appendix 11 which were produced to the same standard of analysis as prescribed for the certification levels.

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- | | | |
|---|-------------------------|--|
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Standards;' February 1992 |
| 2 | BCAR | British Civil Airworthiness
Requirements Section N - Noise
(CAP 469), Issue 5
1 August 1990 |
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Part 36 Noise Standards: Aircraft
Type and Airworthiness
Certification (Including Changes 1
to 23 incorporating Amendments 36-1
to 36-18)
Effective: 18 August 1990 |
| 4 | ICAO | ICAO Committee on Aviation
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Certification of Aircraft, WGAR 3
October 1990 |
| 5 | FAA | FAA Advisory Circular AC36-4B Noise
Certification Handbook
23 March 1988 |

<u>AIRCRAFT WEIGHTS</u>		
MAXIMUM TAKE-OFF	95000 lb (43091 kg)	
	97500 lb (44225 kg)	
	99500 lb (45132 kg)	
	101500 lb (46039 kg)	
MAXIMUM LANDING	83000 lb (37648 kg)	
	84500 lb (38328 kg)	
	86500 lb (39235 kg)	
	88500 lb (40142 kg)	
<u>AIRCRAFT GROSS DIMENSIONS</u>		
OVERALL LENGTH	101.5 ft	30.9 m
WING SPAN	86.4 ft	26.3 m
HEIGHT	28.2 ft	8.6 m
<u>ENGINE DESCRIPTION</u>		
ENGINE MANUFACTURER	TEKTRON LYCOMING	
ENGINE DESIGNATION	LF507-1F (where F denotes FADEC)	
ENGINE NOZZLE TYPE:		
	FAN:	PLAIN ANNULAR
	CORE:	PLAIN CONICAL
<u>ENGINE PERFORMANCE</u>		
SEA-LEVEL BYPASS RATIO	5.2	
100% FAN SPOOL RPM	7602	
100% HP SPOOL RPM	20000	
SEA-LEVEL STATIC THRUST IN ISA CONDITIONS	7100 lb	

TABLE 1 - RJ100 AIRCRAFT AND ENGINE DESCRIPTION

<u>TABLE 2(a) - PHASE 1 OF WEIGHT DEVELOPMENT</u>			
Maximum take-off weight lb (kg) 95000 (43091)			
Maximum landing weight lb (kg) 83000 (37648)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.8	88.3	± 0.3
TAKE-OFF			
i) No cutback	93.4	88.8	± 0.2
ii) With cutback	93.4	83.8	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.7	97.2	± 0.2
airbrake CLOSED	98.7	95.6	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.7	94.6	± 0.2
airbrake CLOSED	98.7	93.2	± 0.2

<u>TABLE 2(b) - PHASE 2 OF WEIGHT DEVELOPMENT</u>			
Maximum take-off weight lb (kg) 97500 (44225)			
Maximum landing weight lb (kg) 84500 (38328)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.2	± 0.3
TAKE-OFF			
i) No cutback	93.5	89.4	± 0.2
ii) With cutback	93.5	84.7	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.8	97.3	± 0.2
airbrake CLOSED	98.8	95.7	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.8	94.6	± 0.2
airbrake CLOSED	98.8	93.2	± 0.2

TABLE 2 - RJ100 CERTIFICATION NOISE LEVELS

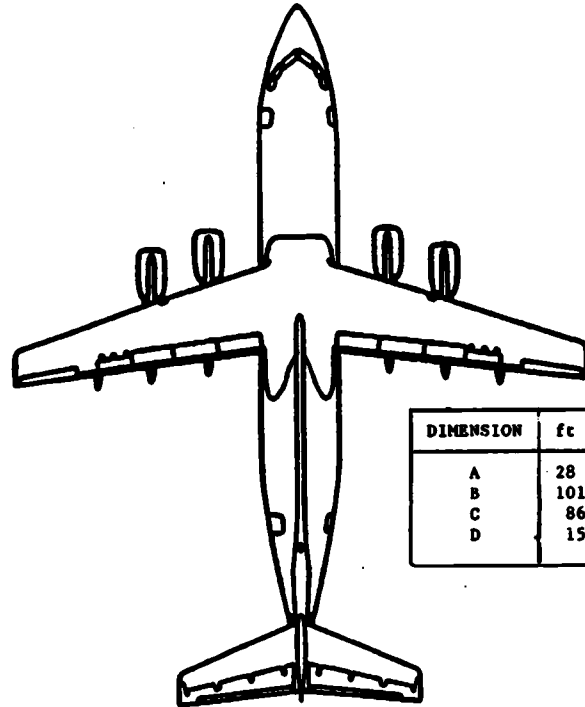
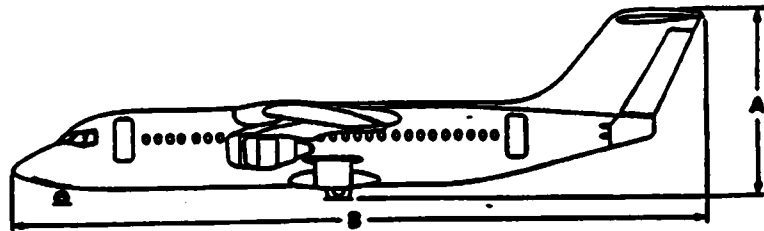
TABLE 2(c) - PHASE 3 OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 97500 (44225) Maximum landing weight lb (kg) 86500 (39235)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.2	± 0.3
TAKE-OFF			
i) No cutback	93.5	89.4	± 0.2
ii) With cutback	93.5	84.7	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.8	97.4	± 0.2
airbrake CLOSED	98.8	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.8	94.7	± 0.2
airbrake CLOSED	98.8	93.2	± 0.2

TABLE 2(d) - PHASE 3 (OPTIONAL) OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 99500 (45132) Maximum landing weight lb (kg) 86500 (39235)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	94.9	88.1	± 0.3
TAKE-OFF			
i) No cutback	93.6	89.8	± 0.2
ii) With cutback	93.6	85.4	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.9	97.4	± 0.2
airbrake CLOSED	98.9	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.9	94.7	± 0.2
airbrake CLOSED	98.9	93.2	± 0.2

TABLE 2 - RJ100 CERTIFICATION NOISE LEVELS (CONTINUED)

TABLE 2(e) - PHASE 4 OF WEIGHT DEVELOPMENT			
Maximum take-off weight lb (kg) 101500 (46039) Maximum landing weight lb (kg) 88500 (40142)			
POSITION	NOISE LIMIT (BCAR SECTION N AND FAR PART 36) EPNdB	CERTIFICATION NOISE LEVEL EPNdB	90% CONFIDENCE INTERVAL EPNdB
SIDELINE	95.0	88.1	± 0.3
TAKE-OFF			
i) No cutback	93.7	90.3	± 0.2
ii) With cutback	93.7	86.1	± 0.2
APPROACH			
i) 33 deg flap:			
airbrake OPEN	98.9	97.6	± 0.2
airbrake CLOSED	98.9	95.8	± 0.2
ii) 24 deg flap:			
airbrake OPEN	98.9	94.7	± 0.2
airbrake CLOSED	98.9	93.2	± 0.2

TABLE 2 - RJ100 CERTIFICATION NOISE LEVELS (CONTINUED)



DIMENSION	ft	in	m
A	28	2	8.59
B	101	6	30.94
C	86	5	26.34
D	15	6	4.72

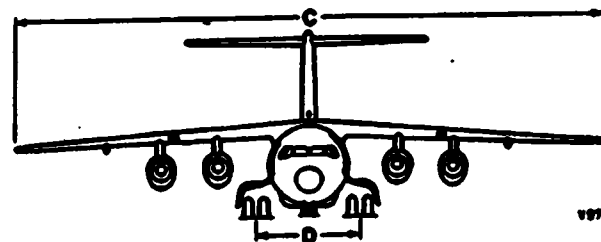


FIGURE 1 - RJ100 GENERAL ARRANGEMENT

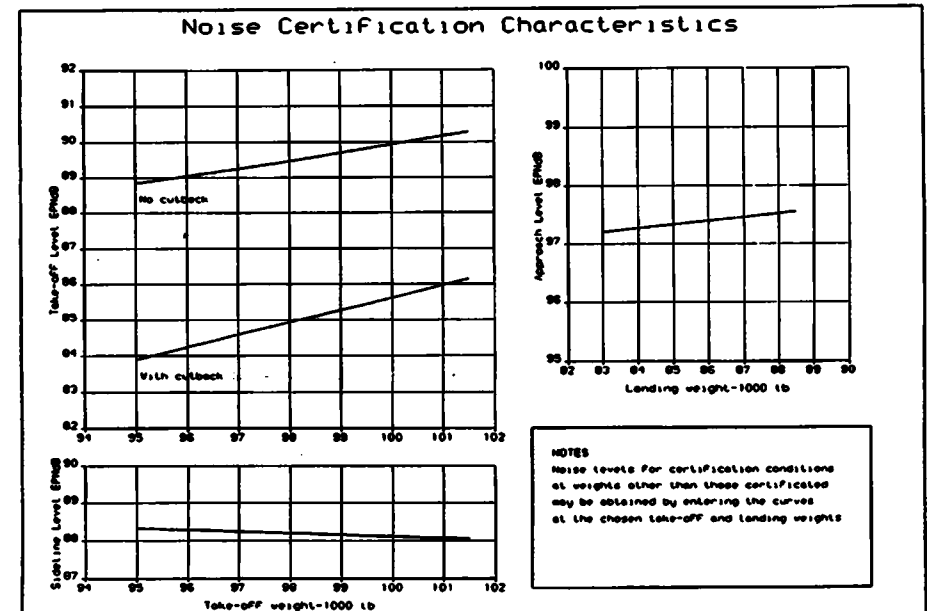


FIGURE 2 - RJ100 CERTIFICATION EPNL VALUES VERSUS AIRCRAFT WEIGHT CHARTS

APPENDIX 1

RJ100 REFERENCE FLIGHT PROFILES

This appendix describes the standards of aircraft and powerplant performance used to determine the relevant parameters for the RJ100 take-off and approach reference flight paths. A detailed discussion on the determination of the reference take-off profiles using cutback procedures is included.

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A1.1 PERFORMANCE STANDARD

The aircraft and powerplant performance standards used in the derivation of the reference take-off and approach profiles below are consistent with those used to produce the Aircraft Flight Manual.

A1.2 REFERENCE CONDITIONS

The reference conditions for demonstrating compliance with BCAR Section N and FAR Part 36 are the same. These are defined below.

A1.2.1 Meteorological

The Series 300 databases used in this submission were corrected to the following reference atmospheric conditions.

- sea level pressure of 1013.25 mb (2116 lbf/ft²)
- ambient temperature of 25°C (77°F)
- relative humidity of 70%
- zero wind

Conditions b), c) and d) above were considered to apply throughout the reference air mass.

The aircraft position and performance data presented in the subsequent sections relate to a sea level airfield with ISA + 10°C atmospheric conditions and zero wind.

A1.2.2 Take-Off

The reference take-off conditions are:

- Maximum Take-Off Weights (MTOW) : 95000 lb (43091 kg)
97500 lb (44225 kg)
99500 lb (45132 kg)
101500 lb (46039 kg)
- take-off climb speed is V_2 + 10 knots appropriate to the MTOW's quoted above.
- the selected take-off flap setting is 18 degrees.
- the use of a cutback procedure above 690 ft (210 metres) with the thrust on all four engines reduced to that which will provide either a climb gradient of at least 4% or level flight with one engine inoperative, whichever thrust is greater.
- forward centre of gravity position.
- engine air bleeds 'OFF'.
- APU operating.

A1.2.3 Approach

The reference approach conditions are:

- Maximum Landing Weights (MLW) : 83000 lb (37648 kg)
84500 lb (38328 kg)
86500 lb (39235 kg)
88500 lb (40142 kg)
- approach speed of $1.3 V_L + 10$ knots appropriate to the MLW's quoted above.
- an approach flap setting of 33 degrees with airbrakes 'open' (the noisiest configuration) and undercarriage down.

(NOTE: 33 degree flaps with airbrakes 'closed' and 24 degree flaps with airbrakes 'open' and 'closed' have been considered so as to provide supplementary noise data for inclusion in the Aircraft Flight Manual.)
- an approach glideslope angle of 3 degree, giving an aircraft height of 394 ft (120 m) above the ground at the noise measuring site.
- forward centre of gravity position.
- engine airbleeds 'ON'.
- APU operating.

A1.3 Derivation of Reference Flight Profiles

A1.3.1 Take-Off Profiles With and Without Cutback

A reference take-off profile consists of a ground run, followed by an acceleration phase from V_L to $V_L + 10$ knots EAS between heights of 35 and 400 feet. Both of these phases use the take-off power rating with 18° flaps selected, engine bleeds 'off' and the APU operating. The aircraft speed and engine power settings are then maintained during the subsequent climb-out phase.

Above 690 ft, a cutback procedure can be initiated when the engine power is reduced to that required to maintain a 4% climb gradient with all engines operating whilst maintaining aircraft speed. In the event of an engine failure this would produce a small positive climb gradient for the RJ100. The point in the flight path at which cutback is initiated is where the full power take-off noise does not intrude into the PNLT time history used for the calculation of the duration correction (ie, it is less than PNLTM-10.5 PNCB).

a) Without Cutback

The take-off profiles without cutback for each of the four MTOW cases under consideration were derived from Reference A1.1. These are shown in Figures A1.1 to A1.4 with the relevant data tabulated below.

		BCAR SECTION N AND FAR PART 36 T/O FLIGHT PROFILES WITHOUT CUTBACK			
Take-Off Weight	lb (kg)	95000 (43091)	97500 (44225)	99500 (45132)	101500 (46039)
T/O Distance to 35 ft	ft	5681	5962	6200	6446
Speed @ 35 ft	kt EAS	148.5	149.7	150.7	151.8
Climb Speed	kt EAS	152.0	153.7	155.0	156.4
Total Distance to:					
400 ft	ft	8549	9023	9422	9828
1000 ft	ft	12827	13512	14086	14674
1500 ft	ft	16495	17363	18089	18833
2000 ft	ft	20261	21319	22202	23110
3000 ft	ft	28098	29555	30772	32026
Take-Off Power					
Net Thrust (Xn) at:					
400 ft	lb/eng	5294	5280	5268	5256
1000 ft	lb/eng	5195	5181	5169	5158
1500 ft	lb/eng	5112	5098	5086	5075
2000 ft	lb/eng	5030	5016	5004	4993
3000 ft	lb/eng	4871	4858	4847	4835
Take-Off @ 21325 ft from SOR					
Height	ft	2136	2001	1893	1791
Minimum Slant Range	ft	2119	1985	1880	1779
Corr. Net Thrust (Xn/6)	lb/eng	5399	5381	5367	5354
Aircraft Speed	kt TAS	159.4	160.9	162.0	163.2

b) With Cutback

It is necessary in the derivation of an optimum cutback take-off profile to select the cutback point such that the noise levels during the time interval defined by PNLTM-10.5 are generated when the engines are operating at cutback power.

The derivation of the cutback point, and subsequently the reference profile, requires knowledge of:

- the spool-down characteristics of the engines,
- the PNLT Noise Power Distance (NPD) relationships,
- the noise directivity characteristics,
- the full power take-off data tabulated above.

The spool-down characteristics were specified in Reference Al.2, Appendix 1, Section Al.3 based on measured data viz:-

- i) eleven seconds were required to reach stabilised cutback power conditions.
- ii) the height gain during the spool-down manoeuvre (the 'bunt') over and above that expected from an instantaneous transition was 40 feet.

The PNLT NPD chart presented in Reference Al.2, Appendix 1, Figure Al.2, covered Minimum Slant Ranges (MSR) spanning 1250 to 2500 ft. This is reproduced as Figure Al.5.

The PNLT directivity plots covering appropriate MSR's are presented in Figures Al.6 to Al.9 for the full power, 87% NI, 79% NI and 71% NI power settings respectively. These (PNLT-PNLTN) versus angle to engine intake axis directivity plots have been derived from the average of four flyover runs performed at each nominal power setting. The 87%, 79% and 71% NI data, which had average measured corrected net thrusts (Xn/6) of 4368, 3268 and 2394 lb/engine respectively, are applicable to the reference cutback values which range from 3293 to 3105 lb/engine. These have been derived from the cutback power charts included in Reference Al.1.

On completion of the spool-down phase, the angle to engine intake axis associated with PNLTN-10.5 can be derived from the directivity plots presented in Figures Al.8 and Al.9 (typically 40 deg). Cutback initiation will then be 11 seconds prior to this. The cutback take-off reference profile can then be calculated using this information together with the full power take-off reference data presented on Page 21.

A summary of the calculation process is given in Tables Al.1 to Al.4 leading to the definition of the cutback take-off reference profiles for each of the four MTOW cases under consideration. In each case the PNLT values at the initiation and at the end of the spool-down are shown to be at least 10.5 PNdB below the cutback PNLTN in accordance with certification practice, ie Reference Al.3 Section 2.2.1 and Reference Al.4 Section 9a(2).

The resulting take-off profiles for the aircraft operating under reference conditions are shown in Figures Al.1 to Al.4 with the relevant data tabulated below.

		BCAR SECTION N AND FAR PART 36 CUTBACK TAKE-OFF DATA			
Take-Off Weight	lb	95000	97500	99500	101500
Cutback Gradient	%	4	4	4	4
Cutback Height	ft	1390	1290	1220	1153
Cutback Fan Speed	NI%	78.0	78.8	79.3	79.9
Engine Net Thrust (Xn)	lb/eng	2930	3010	3070	3135
Take-Off @ 21325 ft from SOR					
Height	ft	1650	1548	1475	1405
Minimum Slant Range	ft	1649	1547	1474	1403
Corr. Net Thrust (Xn/6)	lb/eng	3105	3178	3233	3293
Aircraft Speed	kt TAS	158.3	159.8	161.0	162.3

Al.3.2 Approach Profiles

The approach reference profiles are the same as those presented in Reference Al.2 Appendix 1 Section Al.4 for the Series 300 except that the required thrusts can be produced by slightly lower engine fan speeds (see Section 2 in the main body of this report.)

This approach data are included in the tables below for the four landing configurations scheduled in the Aircraft Flight Manual, and the four landing weights under consideration.

1) 33 deg Flaps, Airbrakes Open (Noisiest Configuration)

BCAR SECTION N AND FAR PART 36 APPROACH DATA					
APPROACH - at a height of 394 ft on a 3 deg glideslope					
Landing Weight	lb	83000	84500	86500	88500
Aircraft speed	kt EAS	129.3	130.4	131.8	133.2
	kt TAS	132.3	133.4	134.8	136.3
Engine fan speed	NI %	70.5	71.0	71.5	72.1
Engine net thrust (Xn)	lb/eng	2355	2394	2447	2500
Corrected net thrust (Xn/6)	lb/eng	2387	2427	2480	2534

2) 33 deg Flaps, Airbrakes Closed

BCAR SECTION N AND FAR PART 36 APPROACH DATA					
APPROACH - at a height of 394 ft on a 3 deg glideslope					
Landing Weight	lb	83000	84500	86500	88500
Aircraft speed	kt EAS	129.3	130.4	131.8	133.2
	kt TAS	132.3	133.4	134.8	136.3
Engine fan speed N1	%	66.0	66.4	66.8	67.3
Engine net thrust (Xn)	lb/eng	1866	1897	1939	1981
Corrected net thrust (Xn/6)	lb/eng	1892	1923	1966	2008

3) 24 deg Flaps, Airbrakes Open

BCAR SECTION N AND FAR PART 36 APPROACH DATA					
APPROACH - at a height of 394 ft on a 3 deg glideslope					
Landing Weight	lb	83000	84500	86500	88500
Aircraft speed	kt EAS	141.0	142.2	143.8	145.3
	kt TAS	144.2	145.5	147.1	148.6
Engine fan speed N1	%	66.8	67.1	67.6	68.1
Engine net thrust (Xn)	lb/eng	1885	1917	1960	2003
Corrected net thrust (Xn/6)	lb/eng	1911	1944	1987	2031

4) 24 deg Flaps, Airbrakes Closed

BCAR SECTION N AND FAR PART 36 APPROACH DATA					
APPROACH - at a height of 394 ft on a 3 deg glideslope					
Landing Weight	lb	83000	84500	86500	88500
Aircraft speed	kt EAS	141.0	142.2	143.8	145.3
	kt TAS	144.2	145.5	147.1	148.6
Engine fan speed N1	%	61.4	61.7	62.0	62.4
Engine net thrust (Xn)	lb/eng	1314	1336	1366	1396
Corrected net thrust (Xn/6)	lb/eng	1332	1356	1386	1416

REFERENCES

- | | |
|--|---|
| <p>A1.1 D R GRAY</p> <p>A1.2 R T HALE
R J WOODROW</p> <p>A1.3 ICAO</p> <p>A1.4 FAA</p> | <p>ADE-ETA-M-462-PF5095 'Bae RJ100 Performance for Noise Certification;' 10 February 1993</p> <p>ADE-ETA-C-463-AC2080; BAE 146 C of A Report No 137; 'BAe 146 Series 300 with LP507 Engines. Compliance with BCAR Section N Noise and with FAR Part 36 Noise Standards;' February 1992</p> <p>ICAO Committee on Aviation Environmental Protection, Environmental Technical Manual on the use of Procedures in the Noise Certification of Aircraft, WGAR 3, October 1990</p> <p>FAA Advisory Circular AC 36-4B Noise Certification Handbook, 23 March 1988</p> |
|--|---|

Take-off Weight 95000 lb
Selected Take-off Flap Setting 18 degrees
Engine Designation LP507-1P
Climb Speed ($V_L + 10$ knots) 152.0 kt EAS

Take-off - No Outback

Take-off Power Flyover Height (from Figure A1.4) = 2136 ft
Take-off Power Minimum Range = 2119 ft
Engine Intake Incidence to Flight Path = 7.6 deg
Full Power Climb Gradient = 12.8 %
Take-off Thrust ($X_{n/6}$) = 5399 lb/eng
Take-off Power PNLTM (Figure A1.5) = 88.7 PNdB

Take-off - Outback Power Phase

Outback Time from Start of Roll = 77.63 sec
Outback Distance from Start of Roll = 15690 ft
Height at Outback Point = 1390 ft
Time at End of Outback Spool-down ($77.63 + 11.00$) = 88.63 sec
Outback Power Climb Gradient = 4 %
Bunt = 40 ft
Height at End of Outback Spool-down = 1547 ft
Angle to Engine Intake Axis at End of Spool-down (PNLT-PNLTM) from Directivity Plots (Figures A1.8 and A1.9) = 41 deg
= at least -10.5 PNdB

Outback Power Flyover Height at 21325 ft from SCR = 1650 ft
Outback Power Minimum Range = 1649 ft
Outback Power Thrust ($X_{n/6}$ at 78.0% N1) = 3105 lb/eng
Aircraft Speed = 158.3 kt TAS
Outback Power PNLTM (Figure A1.5) = 85.0 PNdB

Take-off Power Noise Level at the Initiation of the Outback Procedure

Height = 1390 ft
Angle to Engine Intake Axis (PNLT-PNLTM) from Take-off Power Directivity Figure A1.6 = 29.33 deg
Maximum Full Power Noise Level = -16.6 PNdB
= 88.7 - 16.6
= 72.1 PNdB
ie 12.9 PNdB
less than outback power PNLTM

Noise Level at the End of the Spool-down

Angle to Engine Intake Axis = 41 deg
Noise Level = 85.0 - 10.5
= 74.5 PNdB
ie 10.5 PNdB
less than outback power PNLTM

TABLE A1.1 - DEFINITION OF THE REFERENCE FLIGHT PROFILE

FOR A MTOW = 95000 lb

Take-off Weight 97500 lb
Selected Take-off Flap Setting 18 degrees
Engine Designation LP507-1P
Climb Speed ($V_L + 10$ knots) 153.7 kt EAS

Take-off - No Outback

Take-off Power Flyover Height (from Figure A1.3) = 2001 ft
Take-off Power Minimum Range = 1985 ft
Engine Intake Incidence to Flight Path = 7.6 deg
Full Power Climb Gradient = 12.6 %
Take-off Thrust ($X_{n/6}$) = 5381 lb/eng
Take-off Power PNLTM (Figure A1.5) = 89.4 PNdB

Take-off - Outback Power Phase

Outback Time from Start of Roll = 77.95 sec
Outback Distance from Start of Roll = 15744 ft
Height at Outback Point = 1290 ft
Time at End of Outback Spool-down ($77.95 + 11.00$) = 88.95 sec
Outback Power Climb Gradient = 4 %
Bunt = 40 ft
Height at End of Outback Spool-down = 1448 ft
Angle to Engine Intake Axis at End of Spool-down (PNLT-PNLTM) from Directivity Plots (Figures A1.8 and A1.9) = 40 deg
= at least -10.5 PNdB

Outback Power Flyover Height at 21325 ft from SCR = 1548 ft
Outback Power Minimum Range = 1547 ft
Outback Power Thrust ($X_{n/6}$ at 78.8% N1) = 3178 lb/eng
Aircraft Speed = 159.8 kt TAS
Outback Power PNLTM (Figure A1.5) = 86.1 PNdB

Take-off Power Noise Level at the Initiation of the Outback Procedure

Height = 1290 ft
Angle to Engine Intake Axis (PNLT-PNLTM) from Take-off Power Directivity Figure A1.6 = 28.11 deg
Maximum Full Power Noise Level = -17.4 PNdB
= 89.4 - 17.4
= 72.0 PNdB
ie -14.1 PNdB
less than outback power PNLTM

Noise Level at the End of the Spool-down

Angle to Engine Intake Axis = 40 deg
Noise Level = 86.2 - 10.5
= 75.7 PNdB
ie 10.5 PNdB
less than outback power PNLTM

TABLE A1.2 - DEFINITION OF THE REFERENCE FLIGHT PROFILE

FOR A MTOW = 97500 lb

Take-off Weight	99500	lb
Selected Take-off Flap Setting	18	degrees
Engine Designation	LF507-1P	
Climb Speed ($V_2 + 10$ knots)	155.0	kt EAS

Take-off - No Outback

Take-off Power Flyover Height (from Figure A1.2)	= 1893	ft
Take-off Power Minimum Range	= 1880	ft
Engine Intake Incidence to Flight Path	= 7.7	deg
Full Power Climb Gradient	= 12.2	%
Take-off Thrust ($X_n/6$)	= 5367	lb/eng
Take-off Power PNLTM (Figure A1.5)	= 90.1	PndB

Take-off - Outback Power Phase

Cutback Time from Start of Roll	= 78.36	sec
Cutback Distance from Start of Roll	= 15849	ft
Height at Cutback Point	= 1220	ft
Time at End of Cutback Spool-down ($78.36 + 11.00$)	= 89.36	sec
Cutback Power Climb Gradient	= 4	%
Bunt	= 40	ft
Height at End of Cutback Spool-down	= 1379	ft
Angle to Engine Intake Axis at End of Spool-down (PNLT-PNLTM) from Directivity Plots (Figures A1.8 and A1.9)	= 40	deg
	= at least	
	-10.5	PndB

Cutback Power Flyover Height at 21325 ft from SOR	= 1475	ft
Cutback Power Minimum Range	= 1474	ft
Cutback Power Thrust ($X_n/6$ at 79.3% N1)	= 3233	lb/eng
Aircraft Speed	= 161.0	kt TAS
Cutback Power PNLTM (Figure A1.5)	= 87.0	PndB

Take-off Power Noise Level at the Initiation of the Outback Procedure

Height	= 1220	ft
Angle to Engine Intake Axis (PNLT-PNLTM) from Take-off Power Directivity Figure A1.6	= 27.40	deg
Maximum Full Power Noise Level	= -17.8	PndB
	= 90.1 - 17.8	
	= 72.3	PndB
	ie -14.7	PndB
	less than cutback power PNLTM	

Noise Level at the End of the Spool-down

Angle to Engine Intake Axis	= 40	deg
Noise Level	= 87.0 - 10.5	
	= 76.5	PndB
	ie 10.5	PndB
	less than cutback power PNLTM	

TABLE A1.3 - DEFINITION OF THE REFERENCE FLIGHT PROFILE

FOR A MTOW = 99500 lb

Take-off Weight	101500	lb
Selected Take-off Flap Setting	18	degrees
Engine Designation	LF507-1P	
Climb Speed ($V_2 + 10$ knots)	156.4	kt EAS

Take-off - No Outback

Take-off Power Flyover Height (Figure A1.1)	= 1791	ft
Take-off Power Minimum Range	= 1779	ft
Engine Intake Incidence to Flight Path	= 7.7	deg
Full Power Climb Gradient	= 11.7	%
Take-off Thrust ($X_n/6$)	= 5354	lb/eng
Take-off Power PNLTM (Figure A1.5)	= 90.8	PndB

Take-off - Outback Power Phase

Cutback Time from Start of Roll	= 78.90	sec
Cutback Distance from Start of Roll	= 15951	ft
Height at Cutback Point	= 1153	ft
Time at End of Cutback Spool-down ($78.90 + 11.00$)	= 89.9	sec
Cutback Power Climb Gradient	= 4	%
Bunt	= 40	ft
Height at End of Cutback Spool-down	= 1314	ft
Angle to Engine Intake Axis at End of Spool-down (PNLT-PNLTM) from Directivity Plots (Figures A1.7 and A1.8)	= 40	deg
	= at least	
	-10.5	PndB

Cutback Power Flyover Height at 21325 ft from SOR	= 1405	ft
Cutback Power Minimum Range	= 1403	ft
Cutback Power Thrust ($X_n/6$ at 79.9% N1)	= 3293	lb/eng
Aircraft Speed	= 162.3	kt TAS
Cutback Power PNLTM (Figure A1.5)	= 87.8	PndB

Take-off Power Noise Level at the Initiation of the Outback Procedure

Height	= 1153	ft
Angle to Engine Intake Axis (PNLT-PNLTM) from Take-off Power Directivity Figure A1.6	= 26.68	deg
Maximum Full Power Noise Level	= -18.9	PndB
	= 90.8 - 18.9	
	= 71.9	PndB
	ie 15.9	PndB
	less than cutback power PNLTM	

Noise Level at the End of the Spool-down

Angle to Engine Intake Axis	= 40	deg
Noise Level	= 87.8 - 10.5	
	= 77.3	PndB
	ie 10.5	PndB
	less than cutback power PNLTM	

TABLE A1.4 - DEFINITION OF THE REFERENCE FLIGHT PROFILE

FOR A MTOW = 101500 lb

1000FT0.1LS Chart 9

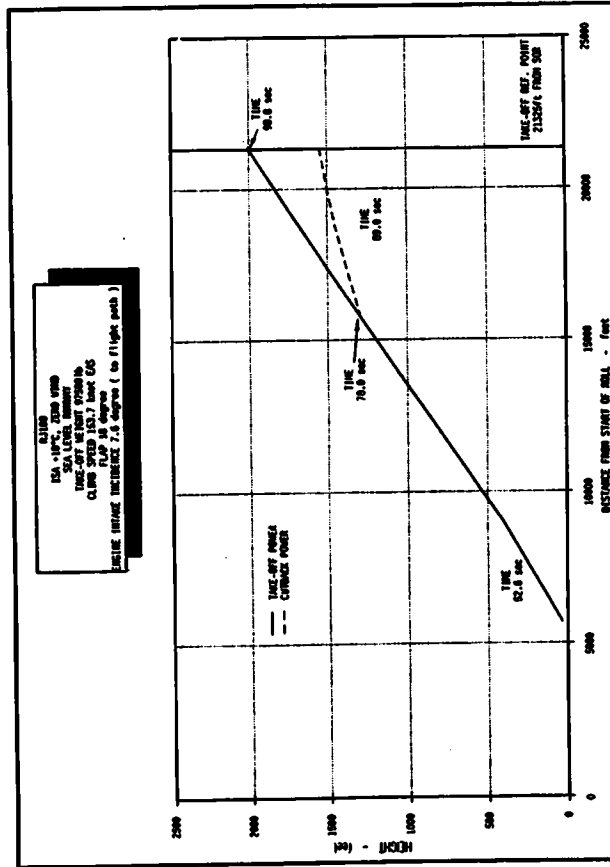


FIGURE AL.2 REFERENCE TAKE-OFF FLIGHT PROFILE FOR A MTOW = 97500lb

1000FT0.1LS Chart 10

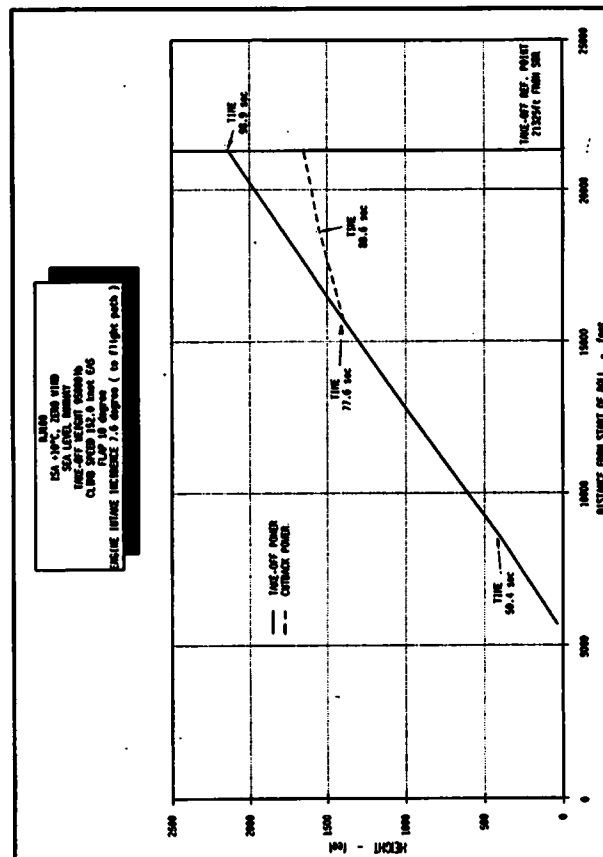


FIGURE AL.1 REFERENCE TAKE-OFF FLIGHT PROFILE FOR A MTOW = 95000lb

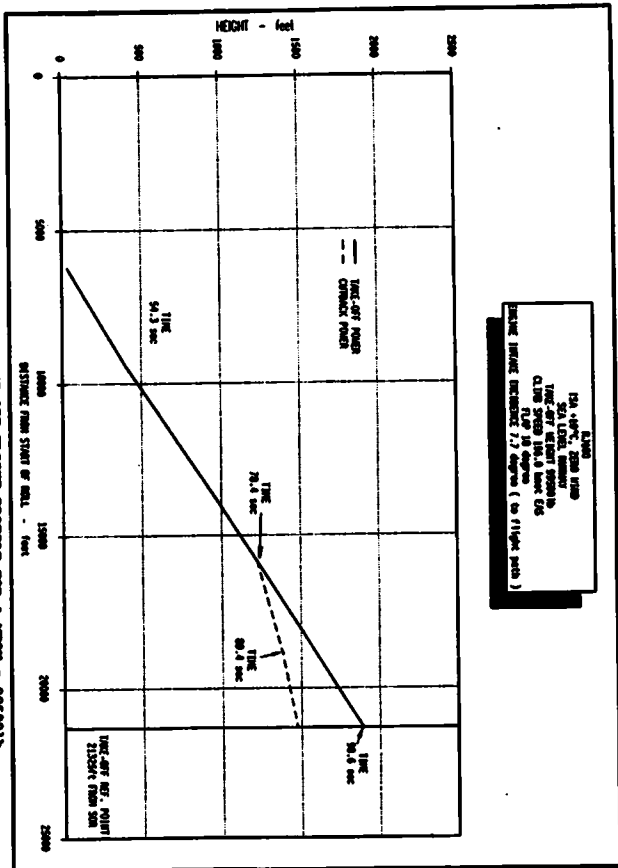


FIGURE AL.3 REFERENCE TAKE-OFF FLIGHT PROFILE FOR A N70W - 995001b

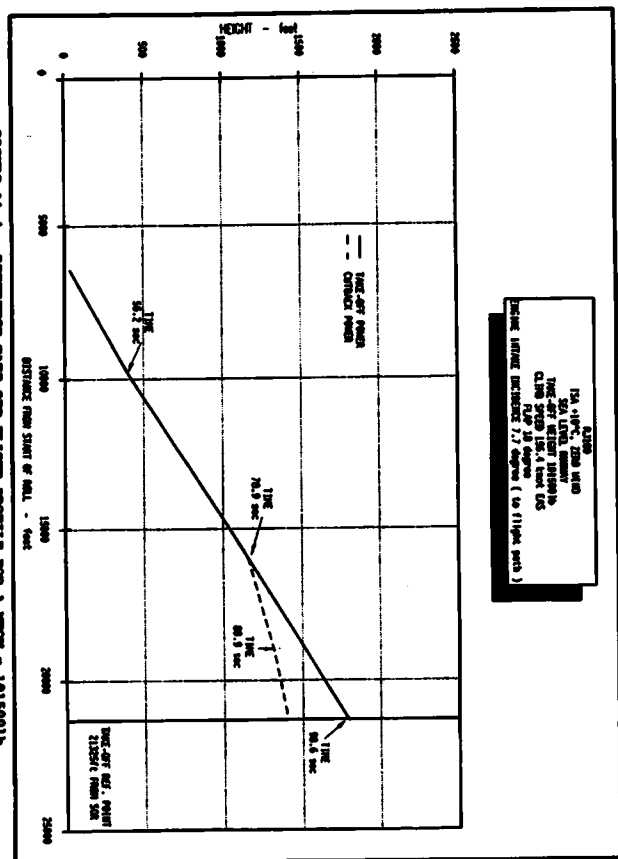


FIGURE AL.4 REFERENCE TAKE-OFF FLIGHT PROFILE FOR A N70W - 1015001b

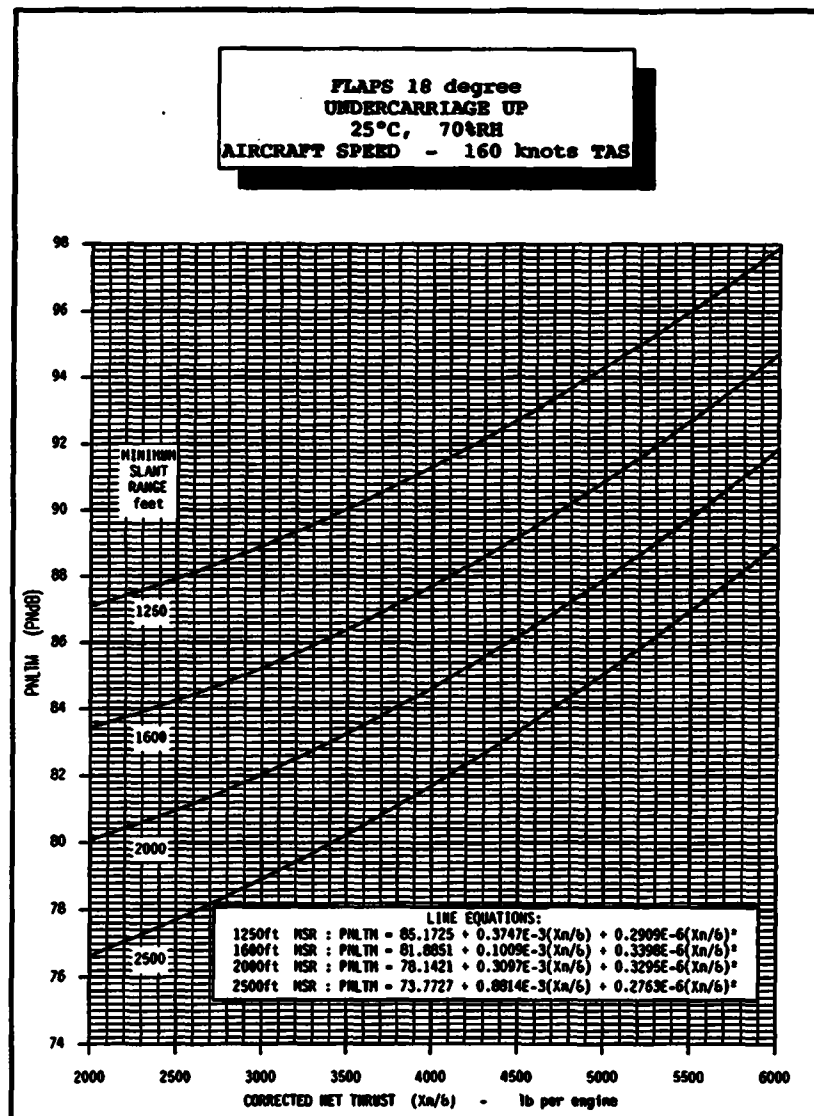


FIGURE A1.5 TAKE-OFF PNLTH NPD CHART

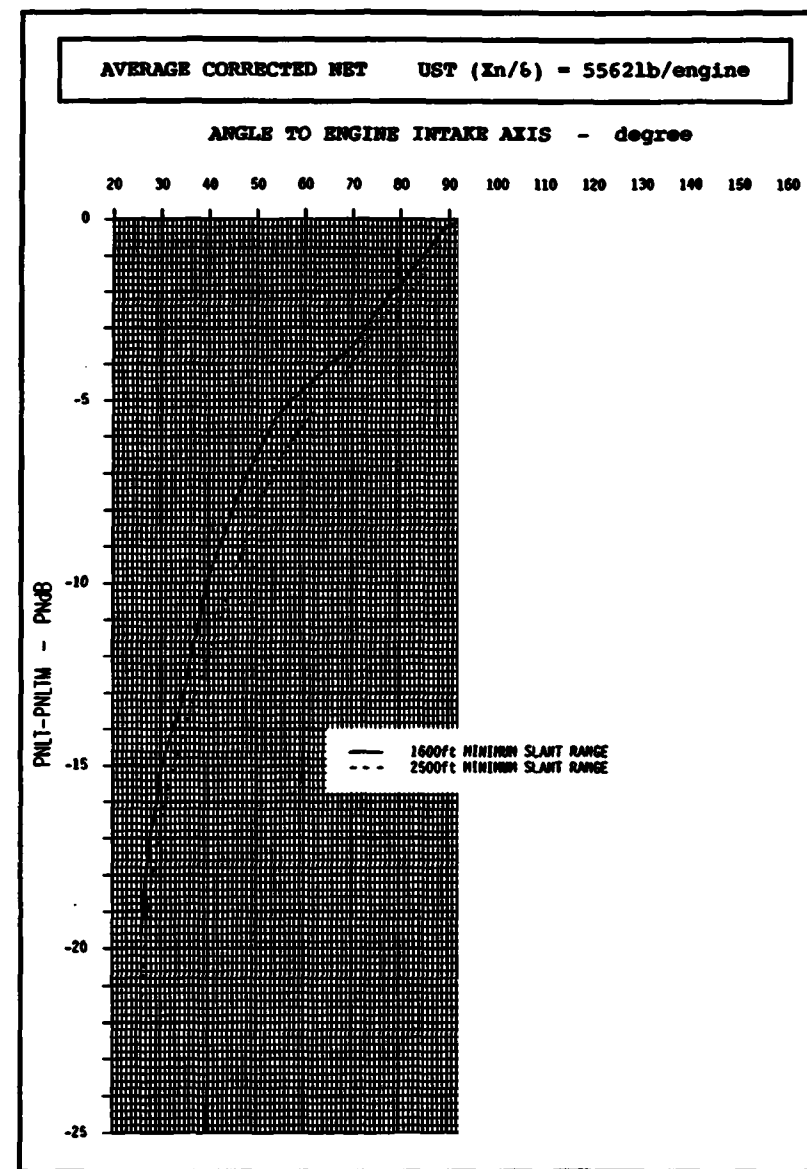


FIGURE A1.6 PNLTH DIRECTIVITY: TAKE - OFF POWER

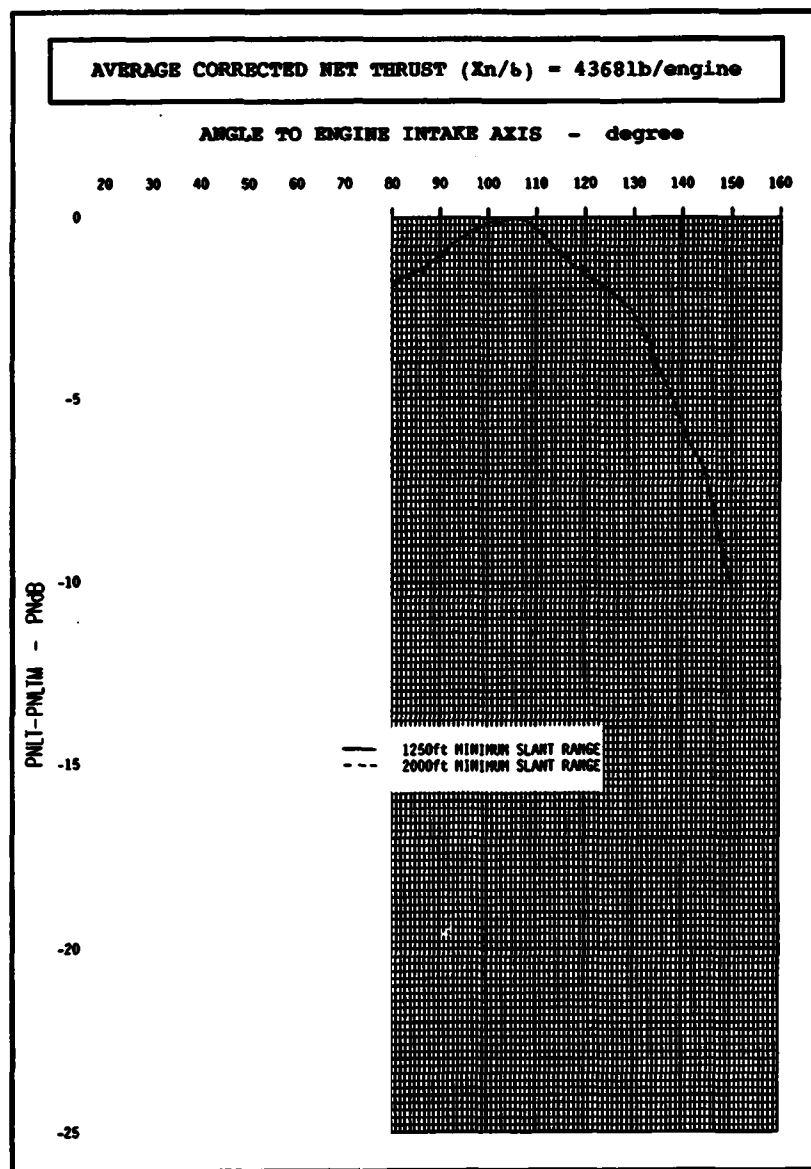


FIGURE A1.7 PNLT DIRECTIVITY : 87% FAN SPEED

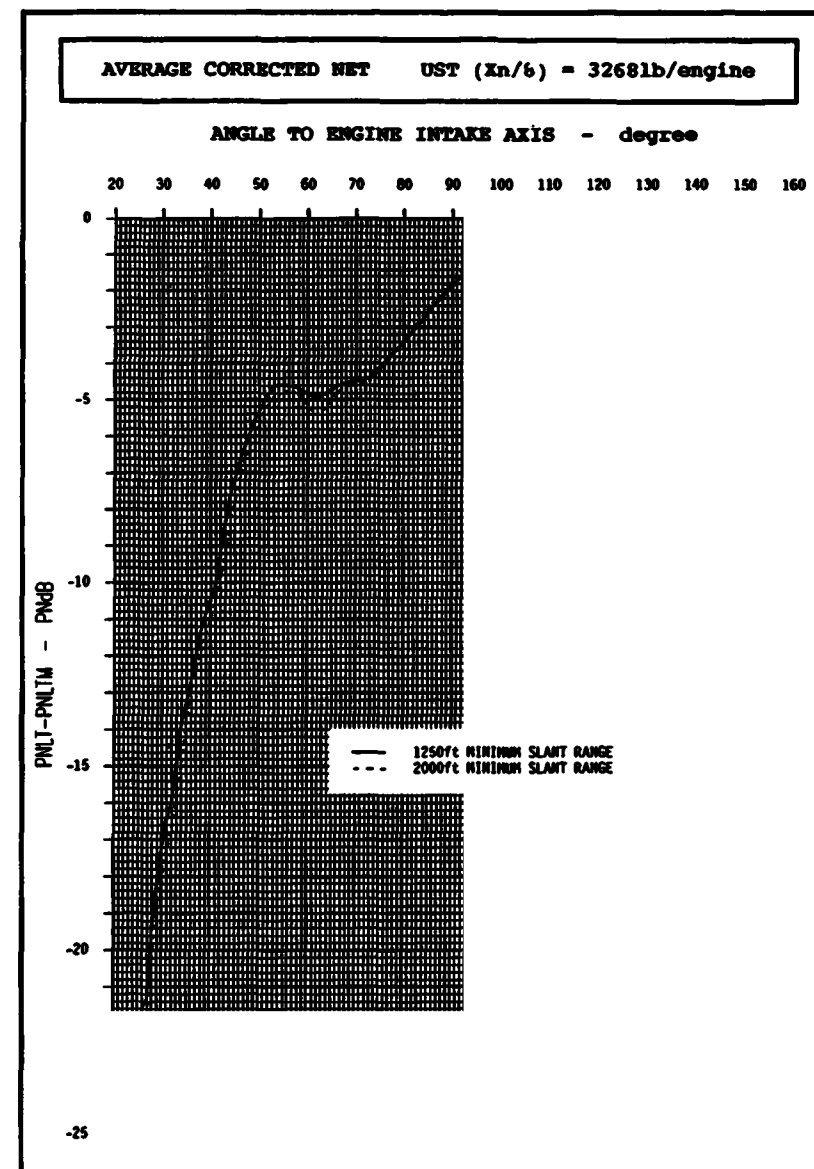


FIGURE A1.8 PNLT DIRECTIVITY : 79% FAN SPEED

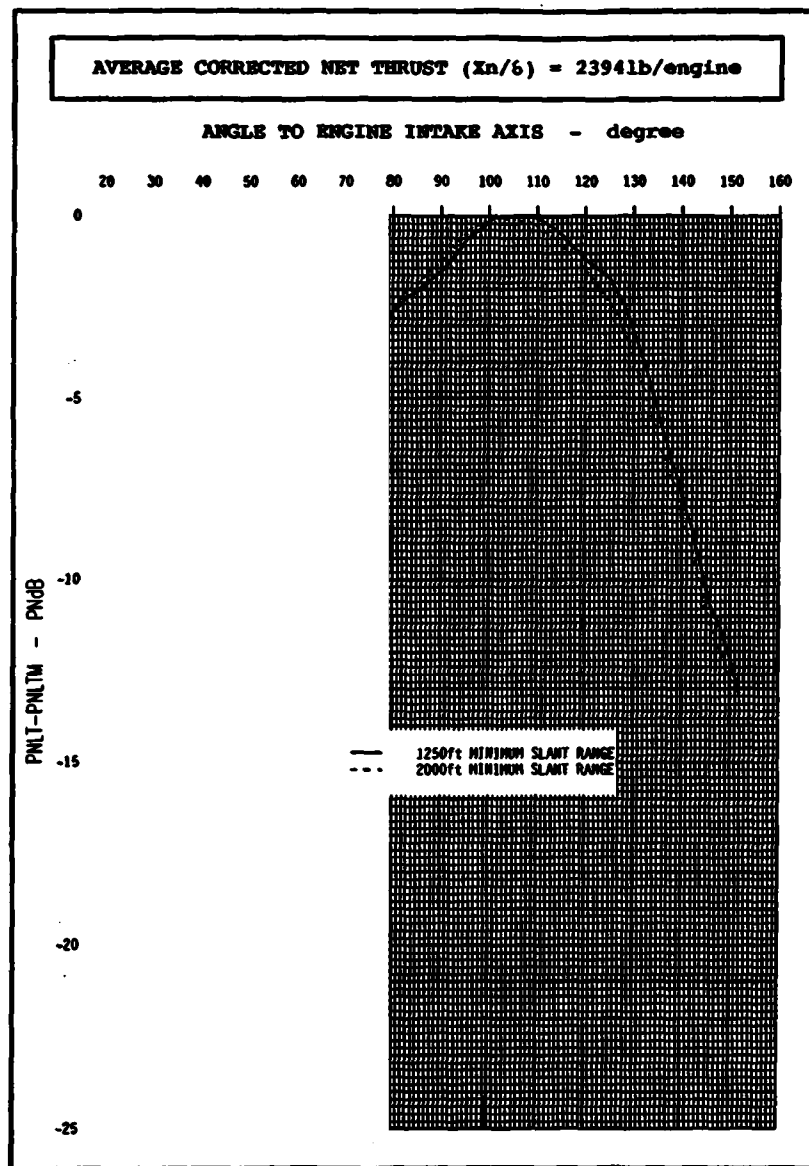


FIGURE A1.9 PNLT DIRECTIVITY : 71% FAN SPEED

APPENDIX 2

DERIVATION OF THE RJ100 SIDELINE NOISE LEVELS

This appendix describes the derivation of the sideline noise levels for the four MTOW cases under consideration. It uses the measured Series 300 sideline noise database submitted in Bae C of A Report No 137 in conjunction with the RJ100 reference take-off flight profiles derived in Appendix 1.

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A2.2 Measured Sideline Noise Data and Corrections Site 'C' (Port Side) MTOW = 97500 lb
A2.3 Measured Sideline Noise Data and Corrections Site 'C' (Port Side) MTOW = 99500 lb
A2.4 Measured Sideline Noise Data and Corrections Site 'C' (Port Side) MTOW = 101500 lb
A2.5 Measured Sideline Noise Data and Corrections Site 'F' (Starboard Side) MTOW = 95000 lb
A2.6 Measured Sideline Noise Data and Corrections Site 'F' (Starboard Side) MTOW = 97500 lb
A2.7 Measured Sideline Noise Data and Corrections Site 'F' (Starboard Side) MTOW = 99500 lb
A2.8 Measured Sideline Noise Data and Corrections Site 'F' (Starboard Side) MTOW = 101500 lb
A2.9 Average Corrected Sideline Data

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FIGURES

- A2.1 Sideline Noise v Thrust : Port Side
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- A2.3 Variation of Sideline Noise with Aircraft Height for a MTOW 95000 lb
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- A2.5 Variation of Sideline Noise with Aircraft Height for a MTOW 99500 lb
- A2.6 Variation of Sideline Noise with Aircraft Height for a MTOW 101500 lb

A2.1 CALCULATION PROCEDURE

The EPNL values, measured at both sideline sites (ie 'C' and 'P') during each of the valid runs used to define the peak sideline noise level, have been corrected to the reference full power take-off climb profiles (defined in Appendix 1, Section A1.3.1(a)). The resulting fully corrected values of EPNL" for each run are presented in Tables A2.1 to A2.4 for the Port site 'C' and Tables A2.5 to A2.8 for the Starboard site 'P', together with the correction values that have been applied, namely:

A2 - accounts for the change in duration correction due to differences in aircraft range between the test and reference flight paths, and thus remains unchanged from those presented in Reference A2.1 Tables 4 and 5.

A5 - accounts for the change in duration correction due to the difference between test and reference aircraft track speeds. This correction changes with MTOW and is calculated from:

$$A5 = 10 \log_{10} \left[\frac{\text{measured aircraft speed}}{\text{acoustic day reference speed}} \right] \text{ dB}$$

where both the measured and reference speeds are true ground speeds.

SNC - accounts for the difference between the noise generated by the four test powerplants operating at the measured power settings in the test atmospheric conditions and the standard of the average engine operating at the power setting required for the reference flight path in the reference atmospheric conditions. This correction is derived from the noise correction curves for sideline sites 'C' and 'P' reproduced from Reference A2.1, Appendix 6, Figures A6.1 and A6.2 as Figures A2.1 and A2.2.

For each sideline noise run the fully corrected EPNL" values from the two sideline sites have been averaged and tabulated together with the associated aircraft height opposite these sites in Table A2.9. These data points are plotted in Figures A2.3 to A2.6 together with the least squares quadratic curves fitted through them. The peak noise level and associated opposite height are derived from the best fit curve equation and its first derivative. The results from this calculation process are summarised below for each MTOW case under consideration.

		BCAR SECTION N AND FAR PART 36 SIDELINE			
MTOW	lb	95000	97500	99500	101500
@ Peak Sideline Point					
A/C Opposite Height	ft	1238.1	1238.2	1237.9	1238.2
Corrected Net Thrust (Xn/6)	lb/eng	5384	5370	5357	5346
Aircraft Speed	kt TAS	157.4	159.1	160.5	161.9
Peak Sideline EPNL*	EPNdB	88.33	88.23	88.14	88.06
- rounded	EPNdB	88.3	88.2	88.1	88.1

A2.2 90% CONFIDENCE INTERVALS

The 90% confidence interval curves are shown in Figures A2.3 to A2.6. These data have been derived by the same methodology as that used in the original noise submission (Reference A2.1). At peak sideline noise, the 90% confidence intervals have been determined as ± 0.3 EPNdB for each of the MTOW cases under consideration. This is well within the ± 1.5 EPNdB confidence limits prescribed in BCAR Section N and FAR Part 36.

REFERENCES

A2.1 R T HALE
R J WOODROW

ADE-EFE-C-463-AC2080, Bae 146 C of A Report No 137, 'Bae 146 Series 300 with LF507 Engines. Compliance with BCAR Section N Noise and with FAR Part 31 Noise Standards'; February 1992

NOISE RUN NO.	AVERAGE HEIGHT OPPOSITE SITES feet	MEASURED NOISE DATA					MULTI CORRECTIONS			CORRECTIONS TO EPNL				EPNL*
		PWLR	C(N)	PWLR	0	EPNL	d1	d2	d3	d1- d2+d3	d2	d5	SNC	
A06	411	05.62	0.21	05.83	-1.01	04.82	-0.07	0.23	0.00	0.23	0.00	0.30	-0.20	05.23
A47	590	06.12	0.40	06.00	-1.62	05.98	-0.05	0.20	0.00	0.20	0.00	0.35	-0.40	07.13
B52	525	07.41	1.02	06.43	-0.00	07.63	-0.07	-1.13	0.00	-1.13	0.00	0.40	-0.10	06.91
B63	667	08.71	0.40	08.11	-1.33	06.78	-0.03	-1.13	0.00	-1.13	0.00	0.43	-0.40	07.09
B64	799	09.01	0.82	08.83	-1.49	08.34	-0.02	-1.09	0.00	-1.09	0.00	0.50	-0.45	08.29
B66	867	09.07	0.79	08.66	-0.96	08.71	-0.04	-1.00	0.00	-1.00	0.00	0.50	-0.34	08.79
B68	918	09.72	0.79	09.51	-2.03	08.48	-0.03	-1.04	0.00	-1.06	0.00	0.44	-0.20	07.58
C58	1100	08.37	0.72	08.09	0.31	08.41	-0.04	-0.77	0.00	-0.77	0.00	0.45	-0.35	08.74
C59	1000	08.43	0.33	08.76	-1.70	08.00	-0.02	-1.05	0.00	-1.05	0.00	0.45	-0.35	08.05
C60	1007	08.33	0.60	08.43	-1.13	08.30	-0.04	-1.06	0.00	-1.06	0.00	0.20	-0.22	08.30
D61	1136	08.08	1.02	08.02	-0.00	08.17	-0.04	-1.03	0.00	-1.03	0.00	0.61	-0.00	08.67
D62	1401	08.12	1.13	08.25	-0.62	08.63	-0.04	-0.71	0.00	-0.71	0.00	0.26	0.20	08.37
B64	1191	08.50	0.94	08.52	-1.10	08.42	-0.03	-1.06	0.00	-1.06	0.00	0.35	0.07	07.70
B65	1106	08.67	1.20	08.67	-0.46	08.41	-0.04	-0.87	0.00	-0.87	0.00	0.22	-0.36	08.41
E06	1754	08.79	1.73	08.52	-0.20	08.24	-0.07	-0.80	0.00	-0.80	0.00	0.23	-0.31	07.58
E07	1500	07.00	1.00	06.17	-0.46	07.72	-0.05	-0.77	0.00	-0.77	0.00	0.30	-0.34	06.91
E08	1507	08.96	1.01	08.96	-0.49	08.47	-0.07	-0.84	0.00	-0.84	0.00	0.18	-0.35	08.46
F09	2247	08.24	1.07	06.31	0.77	06.26	-0.05	-0.82	0.00	-0.82	0.00	0.06	-0.00	04.61
F70	2112	04.72	1.47	06.19	0.93	07.12	-0.05	-0.87	0.00	-0.87	0.00	0.07	-0.79	05.53
H02	1213	08.04	0.00	01.72	-1.55	00.16	-0.02	-0.82	0.00	-0.82	0.00	0.36	-0.00	00.00
H05	1181	09.00	1.23	08.23	-0.75	08.48	-0.05	-0.94	0.00	-0.94	0.00	0.33	-0.57	08.20

TABLE A2.1
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'C' (PORT SIDE) MTOW = 95000lb

NOISE.MS

NOISE NUM ID.	AVERAGE HEIGHT OPPOSITE SITES Feet	MEASURED NOISE DATA			PMT CORRECTIONS				CORRECTIONS TO EPL			
		PM10	C(1)	PM10	0	EPL	d1	d2	d3	d4	d5	SNC
A45	411	65.62	0.21	65.63	-1.01	64.62	-0.07	0.23	0.00	0.23	0.00	-0.20
B47	580	66.12	0.40	66.60	-1.62	65.50	-0.06	0.20	0.00	0.20	0.00	-0.49
B52	525	67.41	1.02	68.43	-0.99	67.43	-0.07	-1.13	0.00	-1.13	0.00	-0.27
B53	607	68.71	0.40	69.11	-1.33	68.70	-0.03	-1.13	0.00	-1.13	0.00	-0.49
B54	790	69.01	0.82	70.83	-1.49	69.34	-0.02	-1.00	0.00	-1.00	0.00	-0.54
B55	667	69.67	0.79	70.46	-0.96	69.71	-0.04	-1.00	0.00	-1.00	0.00	-0.43
B56	910	69.72	0.79	70.51	-2.03	68.41	-0.04	-0.77	0.00	-0.77	0.00	-0.37
C50	1109	69.37	0.72	70.09	0.31	69.41	-0.04	-0.77	0.00	-0.77	0.00	-0.44
C59	1009	69.43	0.33	70.76	-1.76	68.60	-0.02	-1.06	0.00	-1.06	0.00	-0.36
C60	1007	69.33	0.80	70.13	-1.13	69.30	-0.04	-1.06	0.00	-1.06	0.00	-0.31
D61	1135	69.00	1.02	70.02	-0.85	69.17	-0.04	-1.03	0.00	-1.03	0.00	-0.17
D62	1401	68.12	1.13	69.25	-0.63	68.53	-0.04	-0.71	0.00	-0.71	0.00	0.10
E64	1191	68.58	0.94	69.52	-1.10	68.42	-0.03	-1.06	0.00	-1.06	0.00	-0.02
E65	1196	68.67	1.20	69.87	-0.46	68.41	-0.04	-0.87	0.00	-0.87	0.00	-0.14
F66	1750	68.79	1.73	69.52	-0.20	68.24	-0.07	-0.80	0.00	-0.80	0.00	-0.40
F67	1500	67.00	1.00	68.17	-0.46	67.22	-0.05	-0.77	0.00	-0.77	0.00	-0.53
F68	1807	66.95	1.01	67.96	-0.40	66.47	-0.07	-0.84	0.00	-0.84	0.00	-0.44
F69	2207	66.24	1.07	67.31	0.77	66.25	-0.05	-0.82	0.00	-0.82	0.00	-0.03
F70	2112	64.72	1.47	66.19	0.83	67.12	-0.05	-0.87	0.00	-0.87	0.00	-0.02
H002	1213	69.64	0.80	71.72	-1.56	70.16	-0.02	-0.82	0.00	-0.82	0.00	-0.26
H005	1101	69.00	1.23	70.23	-0.75	69.48	-0.05	-0.94	0.00	-0.94	0.00	-0.76

TABLE A2.1
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'C' (PORT SIDE)
KRON = 995001b

NOISE.MS

NOISE NUM ID.	AVERAGE HEIGHT OPPOSITE SITES Feet	MEASURED NOISE DATA			PMT CORRECTIONS				CORRECTIONS TO EPL			
		PM10	C(1)	PM10	0	EPL	d1	d2	d3	d4	d5	SNC
A45	411	65.62	0.21	65.63	-1.01	64.62	-0.07	0.23	0.00	0.23	0.00	-0.20
B47	580	66.12	0.40	66.60	-1.62	65.50	-0.06	0.20	0.00	0.20	0.00	-0.49
B52	525	67.41	1.02	68.43	-0.99	67.43	-0.07	-1.13	0.00	-1.13	0.00	-0.23
B53	607	68.71	0.40	69.11	-1.33	68.70	-0.03	-1.13	0.00	-1.13	0.00	-0.45
B54	790	69.01	0.82	70.83	-1.49	69.34	-0.02	-1.00	0.00	-1.00	0.00	-0.50
B55	667	69.67	0.79	70.46	-0.96	69.71	-0.04	-1.00	0.00	-1.00	0.00	-0.39
B56	910	69.72	0.79	70.51	-2.03	68.41	-0.04	-0.77	0.00	-0.77	0.00	-0.40
C50	1109	69.37	0.72	70.09	0.31	69.41	-0.04	-0.77	0.00	-0.77	0.00	-0.30
C59	1009	69.43	0.33	70.76	-1.76	68.60	-0.02	-1.06	0.00	-1.06	0.00	-0.27
C60	1007	69.33	0.80	70.13	-1.13	69.30	-0.04	-1.06	0.00	-1.06	0.00	-0.23
D61	1135	69.00	1.02	70.02	-0.85	69.17	-0.04	-1.03	0.00	-1.03	0.00	0.15
D62	1401	68.12	1.13	69.25	-0.63	68.53	-0.04	-0.71	0.00	-0.71	0.00	0.21
E64	1191	68.58	0.94	69.52	-1.10	68.42	-0.03	-1.06	0.00	-1.06	0.00	0.30
E65	1196	68.67	1.20	69.87	-0.46	68.41	-0.04	-0.87	0.00	-0.87	0.00	-0.40
F66	1750	68.79	1.73	69.52	-0.20	68.24	-0.07	-0.80	0.00	-0.80	0.00	-0.35
F67	1500	67.00	1.00	68.17	-0.46	67.22	-0.05	-0.77	0.00	-0.77	0.00	-0.30
F68	1807	66.95	1.01	67.96	-0.40	66.47	-0.07	-0.84	0.00	-0.84	0.00	-0.40
F69	2207	66.24	1.07	67.31	0.77	66.25	-0.05	-0.82	0.00	-0.82	0.00	-0.01
F70	2112	64.72	1.47	66.19	0.83	67.12	-0.05	-0.87	0.00	-0.87	0.00	-0.04
H002	1213	69.64	0.80	71.72	-1.56	70.16	-0.02	-0.82	0.00	-0.82	0.00	-0.26
H005	1101	69.00	1.23	70.23	-0.75	69.48	-0.05	-0.94	0.00	-0.94	0.00	-0.72

TABLE A2.2
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'C' (PORT SIDE)
KRON = 975001b

100500E.RLS

NOISE SITES	AVERAGE HEIGHT OPPOSITE SITES Feet	MEASURED NOISE DATA				PULI CORRECTIONS				CORRECTIONS TO DPM				DPM*
		PMAP	C(1)	PMAP	0	41	42	43	44	45	46	47	48	
A45	411	86.08	0.87	86.06	-3.09	83.86	-0.86	83.86	-0.86	83.86	-0.86	83.86	-0.86	83.73
A47	500	86.11	1.08	86.19	-1.07	87.32	-0.84	87.32	-0.84	87.32	-0.84	87.32	-0.84	87.42
B42	525	86.23	0.16	86.39	-0.32	86.07	-0.02	86.07	-0.02	86.07	-0.02	86.07	-0.02	86.24
B43	607	86.84	0.42	86.86	-1.39	88.36	-0.01	88.36	-0.01	88.36	-0.01	88.36	-0.01	88.36
B44	799	86.71	0.43	86.71	-1.43	89.71	-0.81	89.71	-0.81	89.71	-0.81	89.71	-0.81	89.72
B45	607	86.33	0.60	86.33	-1.55	88.47	-0.02	88.47	-0.02	88.47	-0.02	88.47	-0.02	88.47
B46	910	86.06	0.69	86.74	-0.96	88.77	-0.02	88.77	-0.02	88.77	-0.02	88.77	-0.02	88.79
C40	1109	86.04	1.31	89.35	-0.88	88.47	-0.10	88.47	-0.10	88.47	-0.10	88.47	-0.10	88.47
C49	1099	87.42	0.95	88.37	-1.08	88.68	-0.25	88.68	-0.25	88.68	-0.25	88.68	-0.25	88.68
C49	1097	86.99	0.29	86.28	-0.36	86.92	-0.14	86.92	-0.14	86.92	-0.14	86.92	-0.14	86.92
D41	1135	87.46	0.89	87.64	0.19	87.83	-0.01	87.83	-0.01	87.83	-0.01	87.83	-0.01	87.79
D42	1481	87.86	1.18	89.15	-0.47	88.69	-0.03	88.69	-0.03	88.69	-0.03	88.69	-0.03	88.52
D44	1191	86.06	0.40	89.64	-0.55	89.10	-0.39	89.10	-0.39	89.10	-0.39	89.10	-0.39	89.13
D45	1186	82.31	1.77	89.07	-0.51	88.56	-0.01	88.56	-0.01	88.56	-0.01	88.56	-0.01	88.53
E46	1754	87.12	1.24	88.36	-0.60	87.76	-0.06	87.76	-0.06	87.76	-0.06	87.76	-0.06	87.37
E47	1589	87.99	1.09	89.04	-0.65	88.42	-0.04	88.42	-0.04	88.42	-0.04	88.42	-0.04	88.39
E48	1587	86.16	1.38	89.54	-0.88	88.68	-0.04	88.68	-0.04	88.68	-0.04	88.68	-0.04	88.74
F49	2247	86.39	0.42	86.47	0.39	87.06	-0.05	87.06	-0.05	87.06	-0.05	87.06	-0.05	86.18
F79	2112	86.87	1.01	88.08	0.42	87.46	-0.04	87.46	-0.04	87.46	-0.04	87.46	-0.04	86.99
H492	1213	86.05	1.08	89.73	-0.60	89.13	-0.02	89.13	-0.02	89.13	-0.02	89.13	-0.02	89.41
H495	1181	86.95	0.68	89.81	-0.53	89.88	-0.02	89.88	-0.02	89.88	-0.02	89.88	-0.02	89.43

TABLE A2.3
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'P' (STARBOARD SIDE) RTOW = 950001b

100500E.RLS

NOISE SITES	AVERAGE HEIGHT OPPOSITE SITES Feet	MEASURED NOISE DATA				PULI CORRECTIONS				CORRECTIONS TO DPM				DPM*
		PMAP	C(1)	PMAP	0	41	42	43	44	45	46	47	48	
A45	411	86.02	0.21	86.03	-1.01	86.82	-0.87	86.82	-0.87	86.82	-0.87	86.82	-0.87	86.88
A47	500	86.12	0.46	86.60	-1.42	86.56	-0.66	86.56	-0.66	86.56	-0.66	86.56	-0.66	86.80
B42	525	87.41	1.02	88.43	-0.60	87.83	-0.87	87.83	-0.87	87.83	-0.87	87.83	-0.87	88.06
B43	607	86.71	0.40	86.11	-1.33	86.78	-0.03	86.78	-0.03	86.78	-0.03	86.78	-0.03	86.43
B44	799	86.81	0.82	86.83	-1.49	88.34	-0.02	88.34	-0.02	88.34	-0.02	88.34	-0.02	88.36
B45	607	86.87	0.79	86.06	-0.96	86.71	-0.04	86.71	-0.04	86.71	-0.04	86.71	-0.04	86.54
B46	910	86.72	0.79	86.51	-0.83	86.48	-0.83	86.48	-0.83	86.48	-0.83	86.48	-0.83	86.33
C40	1109	86.37	0.72	86.89	0.31	86.41	-0.04	86.41	-0.04	86.41	-0.04	86.41	-0.04	86.39
C49	1099	86.43	0.33	86.76	-1.76	86.68	-0.02	86.68	-0.02	86.68	-0.02	86.68	-0.02	86.47
C49	1097	86.33	0.60	86.43	-1.13	86.38	-0.04	86.38	-0.04	86.38	-0.04	86.38	-0.04	86.40
D41	1135	86.06	1.02	86.82	-0.86	89.17	-0.84	89.17	-0.84	89.17	-0.84	89.17	-0.84	88.94
D42	1481	86.12	1.13	86.25	-0.62	86.83	-0.04	86.83	-0.04	86.83	-0.04	86.83	-0.04	86.41
D44	1191	86.06	0.94	89.52	-1.10	88.42	-0.03	88.42	-0.03	88.42	-0.03	88.42	-0.03	88.16
D45	1186	86.67	1.20	88.87	-0.46	88.41	-0.04	88.41	-0.04	88.41	-0.04	88.41	-0.04	88.16
E46	1754	86.79	1.73	88.52	-0.28	88.24	-0.87	88.24	-0.87	88.24	-0.87	88.24	-0.87	87.83
E47	1589	87.09	1.08	88.17	-0.46	87.72	-0.05	87.72	-0.05	87.72	-0.05	87.72	-0.05	87.39
E48	1587	86.16	1.01	88.36	-0.49	88.47	-0.07	88.47	-0.07	88.47	-0.07	88.47	-0.07	88.53
F49	2247	86.34	1.67	86.19	0.53	86.25	-0.05	86.25	-0.05	86.25	-0.05	86.25	-0.05	86.18
F79	2112	86.72	1.47	86.19	0.53	87.12	-0.05	87.12	-0.05	87.12	-0.05	87.12	-0.05	86.99
H492	1213	86.04	0.68	89.72	-1.55	89.15	-0.02	89.15	-0.02	89.15	-0.02	89.15	-0.02	89.41
H495	1181	86.86	1.23	89.83	-0.78	89.48	-0.03	89.48	-0.03	89.48	-0.03	89.48	-0.03	89.43

TABLE A2.4
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'C' (PORT SIDE) RTOW = 1015001b

100106C.XLS

NOISE MAP	AVERAGE HEIGHT OPPOSITE SITES feet	MEASURED NOISE DATA				PMT CORRECTIONS				CORRECTIONS TO EPN				EPN*
		PMN	C(1)	PMN	0	EPN	41	42	43	41+	42	43	44	
A45	411	86.08	0.87	86.95	-3.09	83.86	-0.85	-0.23	0.09	-0.23	0.09	-0.23	0.09	83.83
A47	500	86.11	1.00	87.10	-1.87	85.22	-0.84	-0.31	0.00	-0.31	0.00	-0.31	0.00	85.22
B52	525	86.23	0.16	86.39	-0.32	86.07	-0.82	-0.87	0.00	-0.87	0.00	-0.87	0.00	86.07
B53	607	86.04	0.82	86.86	-1.30	85.74	-0.81	-0.94	0.00	-0.94	0.00	-0.94	0.00	85.74
B64	799	86.71	0.43	87.14	-1.43	85.71	-0.82	-0.85	0.00	-0.85	0.00	-0.85	0.00	85.71
B65	867	86.33	0.80	87.13	-1.55	85.58	-0.82	-1.01	0.00	-1.01	0.00	-1.01	0.00	85.58
B66	910	86.06	0.89	86.95	-0.95	85.10	-0.82	-1.03	0.00	-1.03	0.00	-1.03	0.00	85.10
C50	1009	86.04	1.31	87.35	-0.80	86.54	-0.82	-1.17	0.00	-1.17	0.00	-1.17	0.00	86.54
C59	1009	87.42	0.55	87.97	-1.80	85.67	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.67
C60	1007	86.99	0.29	87.28	-0.38	86.60	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	86.60
B61	1135	87.05	0.99	88.04	-0.19	87.85	-0.81	-0.53	0.00	-0.53	0.00	-0.53	0.00	87.85
B62	1401	87.00	1.10	88.10	-0.47	86.53	-0.82	-0.70	0.00	-0.70	0.00	-0.70	0.00	86.53
B64	1391	86.06	0.30	86.36	-0.56	85.80	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.80
B65	1391	87.31	1.77	89.07	-0.51	88.56	-0.81	-0.40	0.00	-0.40	0.00	-0.40	0.00	88.56
B66	1394	87.12	1.24	88.36	-0.60	87.76	-0.82	-0.63	0.00	-0.63	0.00	-0.63	0.00	87.76
B67	1390	87.09	1.00	88.09	-0.65	86.44	-0.82	-0.75	0.00	-0.75	0.00	-0.75	0.00	86.44
C58	1597	86.16	1.30	87.46	-0.82	85.34	-0.82	-0.85	0.00	-0.85	0.00	-0.85	0.00	85.34
F69	2247	86.20	0.42	86.62	-0.30	86.30	-0.82	-0.84	0.00	-0.84	0.00	-0.84	0.00	86.30
F70	2112	85.82	1.01	86.83	-0.42	85.40	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.40
B102	1213	86.06	1.00	87.06	-0.60	86.46	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	86.46
B105	1181	86.95	0.85	87.80	-0.83	87.02	-0.82	-0.74	0.00	-0.74	0.00	-0.74	0.00	87.02

TABLE A2.7
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'P' (STANDARD SIDE) RTOW = 975001b

100106C.XLS

NOISE MAP	AVERAGE HEIGHT OPPOSITE SITES feet	MEASURED NOISE DATA				PMT CORRECTIONS				CORRECTIONS TO EPN				EPN*
		PMN	C(1)	PMN	0	EPN	41	42	43	41+	42	43	44	
A45	411	86.08	0.87	86.95	-3.09	83.86	-0.85	-0.23	0.09	-0.23	0.09	-0.23	0.09	83.83
A47	500	86.11	1.00	87.10	-1.87	85.22	-0.84	-0.31	0.00	-0.31	0.00	-0.31	0.00	85.22
B52	525	86.23	0.16	86.39	-0.32	86.07	-0.82	-0.87	0.00	-0.87	0.00	-0.87	0.00	86.07
B53	607	86.04	0.82	86.86	-1.30	85.74	-0.81	-0.94	0.00	-0.94	0.00	-0.94	0.00	85.74
B64	799	86.71	0.43	87.14	-1.43	85.71	-0.82	-0.85	0.00	-0.85	0.00	-0.85	0.00	85.71
B65	867	86.33	0.80	87.13	-1.55	85.58	-0.82	-1.01	0.00	-1.01	0.00	-1.01	0.00	85.58
B66	910	86.06	0.89	86.95	-0.95	85.10	-0.82	-1.03	0.00	-1.03	0.00	-1.03	0.00	85.10
C50	1009	86.04	1.31	87.35	-0.80	86.54	-0.82	-1.17	0.00	-1.17	0.00	-1.17	0.00	86.54
C59	1009	87.42	0.55	87.97	-1.80	85.67	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.67
C60	1007	86.99	0.29	87.28	-0.38	86.60	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	86.60
B61	1135	87.05	0.99	88.04	-0.19	87.85	-0.81	-0.53	0.00	-0.53	0.00	-0.53	0.00	87.85
B62	1401	87.00	1.10	88.10	-0.47	86.53	-0.82	-0.70	0.00	-0.70	0.00	-0.70	0.00	86.53
B64	1391	86.06	0.30	86.36	-0.56	85.80	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.80
B65	1391	87.31	1.77	89.07	-0.51	88.56	-0.81	-0.40	0.00	-0.40	0.00	-0.40	0.00	88.56
B66	1394	87.12	1.24	88.36	-0.60	87.76	-0.82	-0.63	0.00	-0.63	0.00	-0.63	0.00	87.76
B67	1390	87.09	1.00	88.09	-0.65	86.44	-0.82	-0.75	0.00	-0.75	0.00	-0.75	0.00	86.44
C58	1597	86.16	1.30	87.46	-0.82	85.34	-0.82	-0.85	0.00	-0.85	0.00	-0.85	0.00	85.34
F69	2247	86.20	0.42	86.62	-0.30	86.30	-0.82	-0.84	0.00	-0.84	0.00	-0.84	0.00	86.30
F70	2112	85.82	1.01	86.83	-0.42	85.40	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	85.40
B102	1213	86.06	1.00	87.06	-0.60	86.46	-0.82	-0.91	0.00	-0.91	0.00	-0.91	0.00	86.46
B105	1181	86.95	0.85	87.80	-0.83	87.02	-0.82	-0.74	0.00	-0.74	0.00	-0.74	0.00	87.02

TABLE A2.6
MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'P' (STANDARD SIDE) RTOW = 975001b

100SIDE.XLS

NOISE RUN NO.	AVERAGE HEIGHT OPPOSITE SITE feet	MEASURED NOISE DATA					MULTI CORRECTIONS			CORRECTIONS TO EPNL				EPNL*
		PWL	C(N)	PWL	D	EPNL	d1	d2	d3	d1+ d2+d3	d2	d3	SHC	
A45	411	86.00	0.87	86.95	-3.89	83.06	-0.06	-0.23	0.00	-0.23	0.00	0.26	-0.16	83.43
B47	590	88.11	1.00	89.19	-1.87	87.32	-0.04	0.31	0.00	0.31	0.00	0.23	-0.74	87.12
B52	525	88.23	0.16	88.39	-0.32	88.07	-0.02	-0.97	0.00	-0.97	0.00	0.27	-0.43	86.94
B53	687	90.04	0.62	90.66	-1.30	89.36	-0.91	-0.94	0.00	-0.94	0.00	0.31	-0.73	88.66
B54	799	90.71	0.43	91.14	-1.43	89.71	-0.01	-0.86	0.00	-0.86	0.00	0.37	-0.81	88.42
B55	867	89.33	0.88	90.01	-1.55	88.47	-0.02	-1.01	0.00	-1.01	0.00	0.38	-0.65	87.19
B56	918	89.06	0.60	89.74	-0.86	88.77	-0.02	-1.03	0.00	-1.03	0.00	0.31	-0.56	87.49
C58	1109	88.04	1.31	89.35	-0.88	88.47	-0.10	-0.76	0.00	-0.76	0.00	0.32	-0.66	87.37
C59	1009	87.42	0.95	88.37	-1.00	86.88	-0.25	-1.17	0.00	-1.17	0.00	0.32	-0.86	85.18
C60	1007	88.99	0.29	89.28	-0.36	88.92	-0.14	-0.91	0.00	-0.91	0.00	0.15	-0.40	87.68
D61	1135	87.05	0.59	87.64	0.19	87.83	-0.01	-0.53	0.00	-0.53	0.00	0.49	-0.29	87.49
D62	1401	87.98	1.10	89.10	-0.47	88.69	-0.03	-0.70	0.00	-0.70	0.00	0.13	0.09	88.21
D64	1191	89.06	0.58	89.64	-0.55	89.10	-0.10	-0.62	0.00	-0.62	0.00	0.22	-0.08	88.83
D66	1186	87.31	1.77	89.07	-0.51	88.56	-0.01	-0.49	0.00	-0.49	0.00	0.10	-0.57	87.59
E66	1754	87.12	1.34	88.36	-0.88	87.76	-0.06	-0.63	0.00	-0.63	0.00	0.11	-0.62	86.82
E67	1588	87.59	1.09	88.68	-0.65	88.42	-0.04	-0.75	0.00	-0.75	0.00	0.17	-0.65	87.66
F69	1987	88.16	1.38	89.54	-0.85	88.68	-0.04	-0.63	0.00	-0.63	0.00	0.05	-0.57	87.44
F70	2247	86.29	0.42	86.67	0.38	87.05	-0.05	-0.67	0.00	-0.67	0.00	-0.07	-1.44	84.88
F70	2112	86.87	1.01	86.88	0.62	87.49	-0.04	-0.45	0.00	-0.45	0.00	-0.05	-1.29	85.89
H102	1213	89.86	1.00	90.73	-0.69	90.13	-0.02	-0.91	0.00	-0.91	0.00	0.23	-1.14	88.31
H105	1181	89.95	0.36	90.31	-0.83	89.50	-0.02	-0.74	0.00	-0.74	0.00	0.21	-1.12	88.33

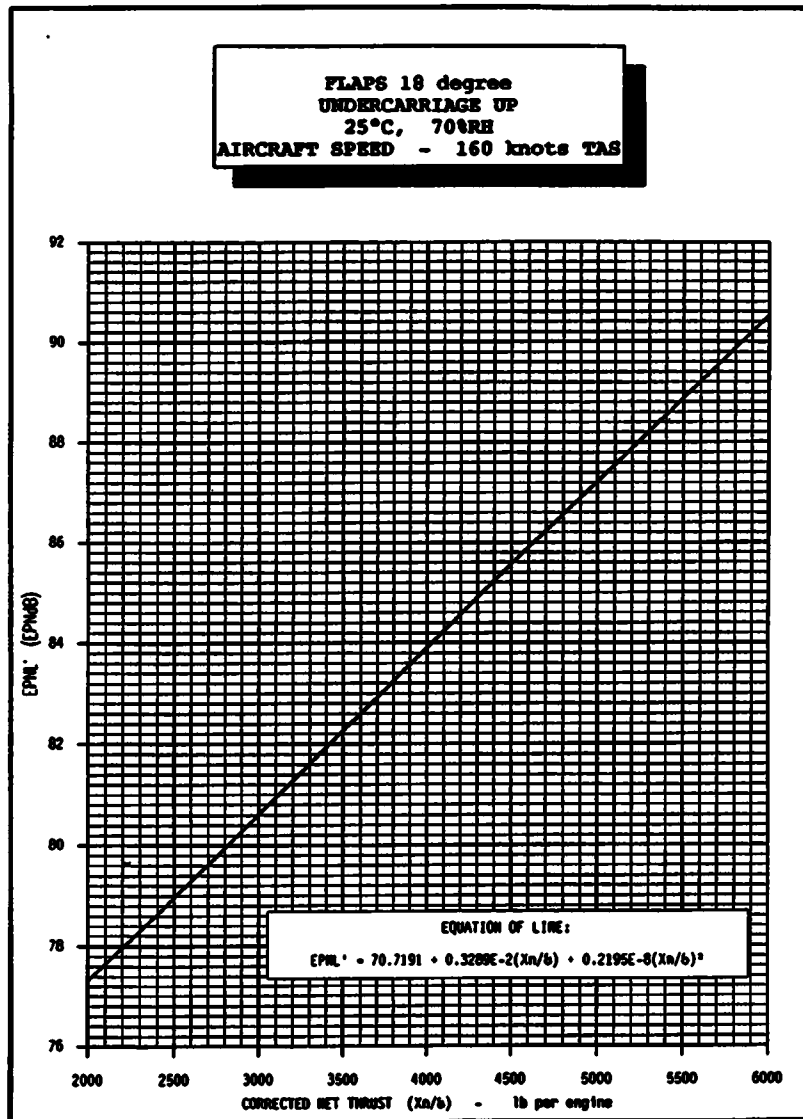
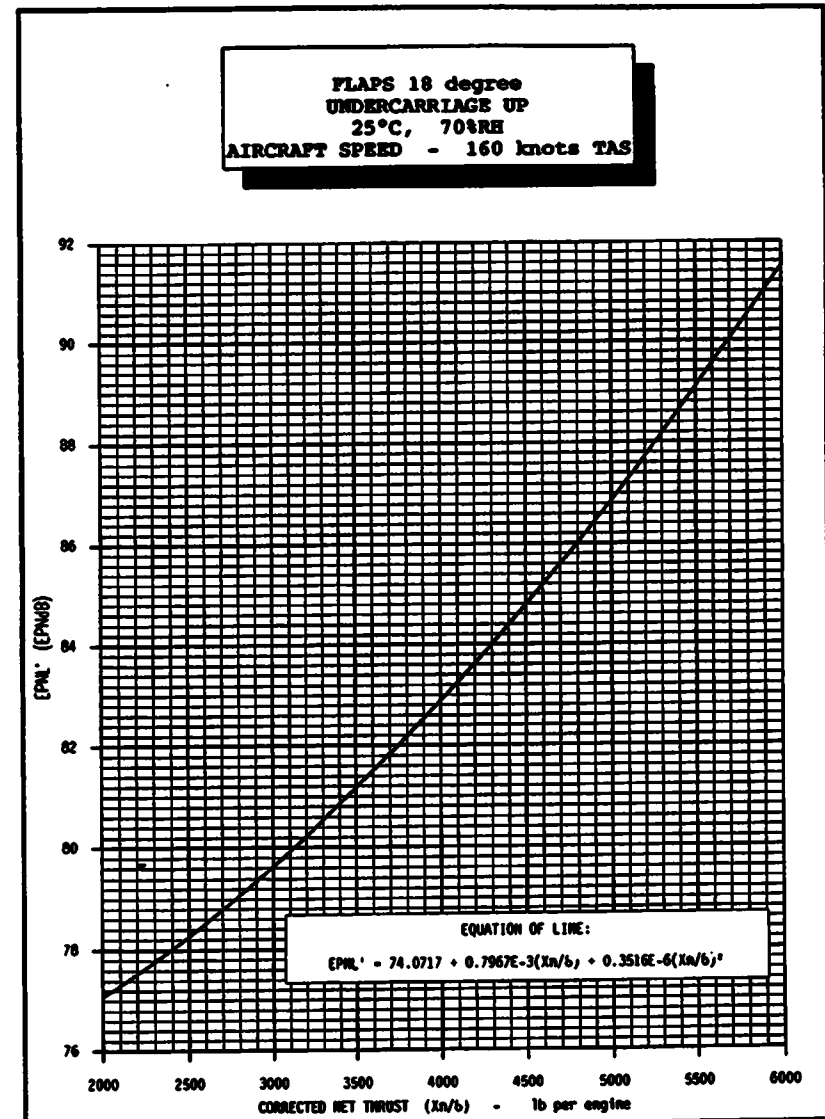
TABLE A2.8

MEASURED SIDELINE NOISE DATA AND CORRECTIONS
SITE 'F' (STARBOARD SIDE) NTOW = 1015001bADE-EFE-C-463-AC0260
Appendix 2
Page No: 50

NOISE RUN NO.	AVERAGE HEIGHT OPPOSITE SITES feet	AVERAGE EPNL* (EPNLdB)			
		.9 NTOW			
		950001b	975001b	995001b	1015001b
A45	411.2	84.48	84.38	84.29	84.20
B47	590.2	87.28	87.17	87.09	87.00
B52	525.3	87.08	86.97	86.89	86.80
B53	686.8	87.99	87.89	87.80	87.72
B54	799.1	88.51	88.40	88.32	88.23
B55	867.1	88.14	88.03	87.95	87.86
B56	918.1	87.68	87.58	87.49	87.41
C58	1109.3	88.21	88.10	88.02	87.93
C59	1009.2	86.76	86.66	86.57	86.49
C60	1007.2	88.14	88.03	87.95	87.86
D61	1134.8	88.23	88.12	88.04	87.95
D62	1481.2	88.44	88.34	88.25	88.17
D64	1191.4	88.45	88.35	88.26	88.18
D66	1186.7	88.15	88.04	87.96	87.87
E66	1754.3	87.10	87.00	86.91	86.83
E67	1587.7	87.14	87.03	86.94	86.86
F69	1987.4	88.10	87.99	87.91	87.82
F70	2246.9	84.09	84.79	84.70	84.61
F70	2112.2	85.76	85.65	85.57	85.48
H102	1212.9	88.81	88.70	88.61	88.53
H105	1181.2	88.41	88.31	88.22	88.14

TABLE A2.9

AVERAGE CORRECTED SIDELINE DATA

**FIGURE A2.1** SIDELINE NOISE ▽ THRUST : PORT SIDE**FIGURE A2.2** SIDELINE NOISE ▽ THRUST : STARBOARD SIDE

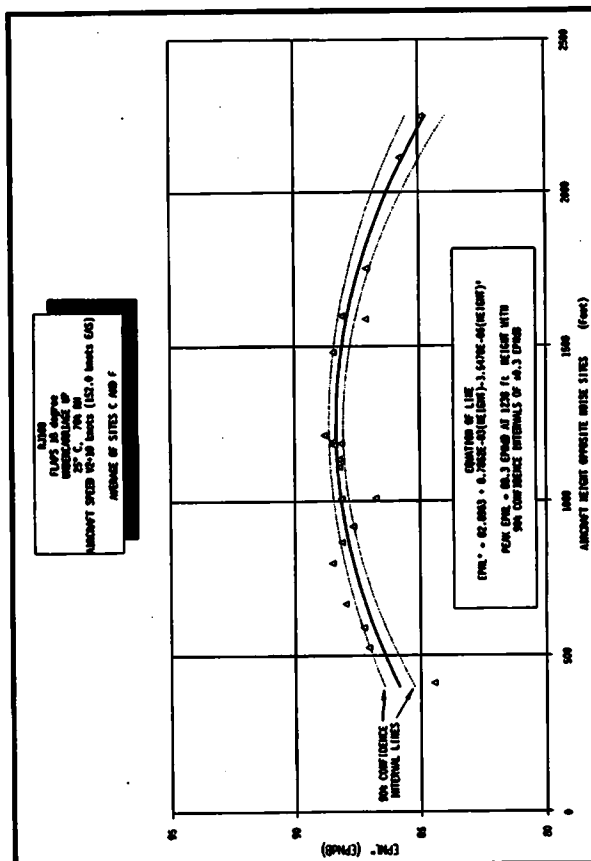
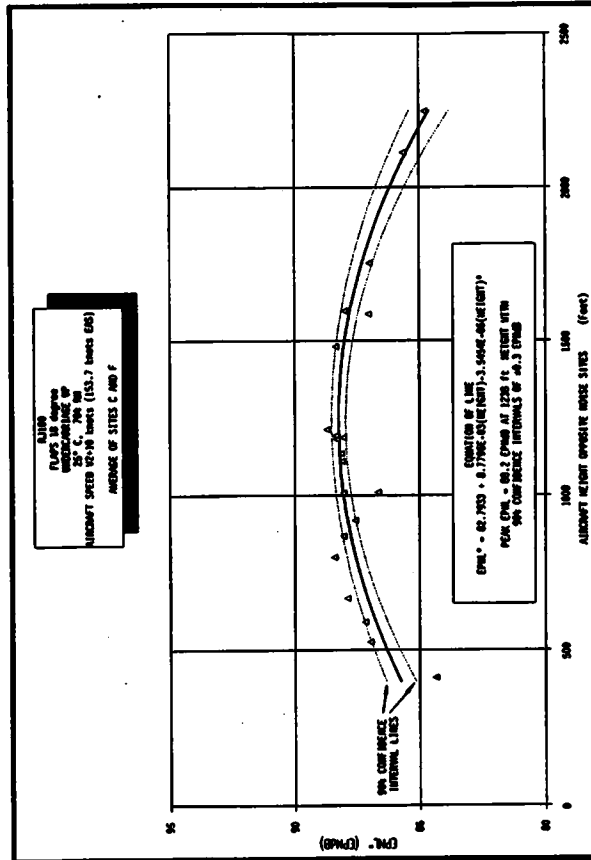


FIGURE A2.5 Chart 6

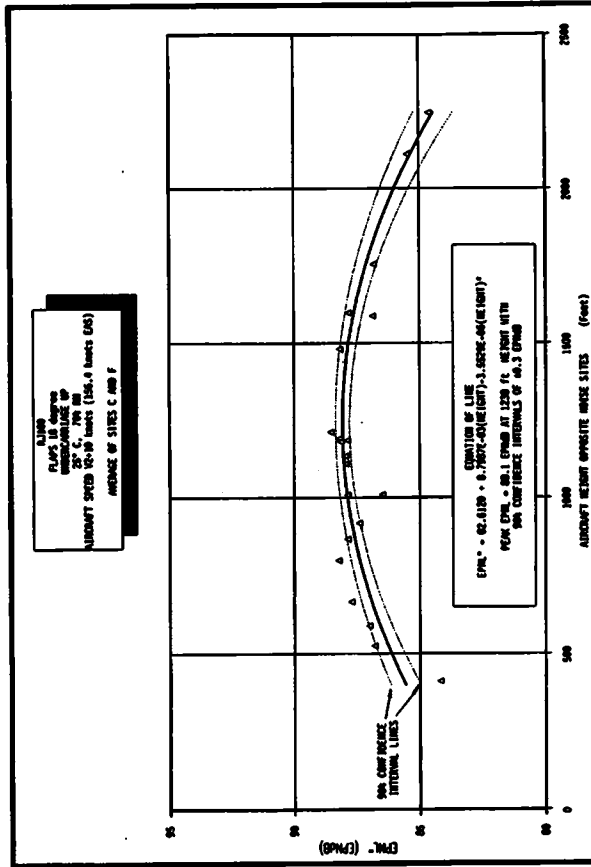


FIGURE A2.5 VARIATION OF SIDELINE NOISE WITH AIRCRAFT HEIGHT FOR A MTOW OF 101500 lb

FIGURE A2.5 Chart 5

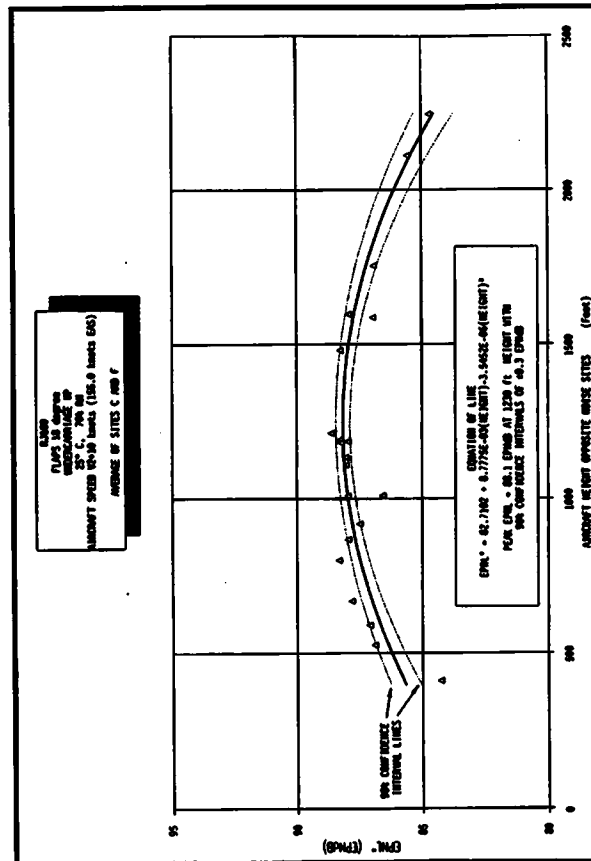


FIGURE A2.5 VARIATION OF SIDELINE NOISE WITH AIRCRAFT HEIGHT FOR A MTOW OF 99500 lb

APPENDIX 3

DERIVATION OF THE RJ100 TAKE-OFF NOISE LEVELS

This appendix describes the derivation of the take-off noise levels with and without cutback for the four MTOW cases under consideration. It uses the measured Series 300 take-off NPD database submitted in BAE C of A Report No 137 in conjunction with the RJ100 reference take-off profiles derived in Appendix 1.

CONTENTS

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A3.1 CALCULATION PROCEDURE	
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A3.1.2 Take-Off Noise Levels With Cutback	59
A3.2 90% CONFIDENCE INTERVALS	60
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FIGURE	
A3.1 Take-Off NPD Chart	62

A3.1 CALCULATION PROCEDURE

Two take-off cases have been considered, ie with and without cutback. The derivation of the associated flyover noise levels are described in Sections A3.1.1 and A3.1.2 below.

A3.1.1 Take-Off Noise Levels Without Cutback

The take-off EPNL' NPD chart in Figure A3.1 has been reproduced from Reference A3.1 Figure 14. This NPD chart has been used in conjunction with the reference take-off flight profiles defined in Appendix 1, Section A1.3.1(a) to determine the take-off without cutback EPNL values. To these have been added a correction to account for the change in duration correction due to the difference in aircraft speed between the reference conditions (Vref) and the NPD (Vnpd), evaluated from 10 Log [Vnpd/Vref].

The steps in the calculation process leading to the derivation of EPNL', the certification take-off level, are presented below for the four Maximum Take-Off Weights (MTOW) under consideration.

Take-Off Without Cutback

MTOW	lb	95000	97500	99500	101500
Height at 21325 ft from SOR	ft	2136	2001	1893	1791
MSR	ft	2119	1985	1880	1779
Xn/6	lb/eng	5399	5381	5367	5354
A/C Speed, Vref	kt TAS	159.4	160.9	162.0	163.2
a) Noise Levels from Figure A3.1, where Vnpd = 160 kt TAS					
at 1600 ft MSR	EPndB	-	91.51	91.46	91.41
at 2000 ft MSR	EPndB	89.38	89.32	89.26	89.21
at 2500 ft MSR	EPndB	87.23	-	-	-
b) Logarithmic interpolation to determine noise level at reference MSR					
at reference MSR	EPndB	88.83	89.39	89.87	90.37
c) Speed Correction 10 Log (Vnpd/Vref)					
	EPndB	0.02	-0.02	-0.05	-0.09
d) Corrected EPNL' - rounded					
	EPndB	88.84	89.37	89.82	90.28
		88.8	89.4	89.8	90.3
e) 90% Confidence Interval +EPndB (see Section A3.2 below)					
		0.16	0.16	0.16	0.16

A3.1.2 Take-Off Noise Levels With Cutback

The same calculation procedure, used for the take-off without cutback case described above, has been used but using the reference take-off with cutback flight profiles defined in Appendix 1, Section A3.1(b). The steps in the calculation process are presented below for the five MTOW's under consideration.

Take-Off With Outback

MTOW	lb	95000	97500	99500	101500
Height at 21325 ft from SOR	ft	1650	1548	1475	1405
MSR	ft	1649	1547	1474	1403
X _{n/6}	lb/eng	3105	3178	3233	3293
A/C Speed, V _{ref}	kt TAS	158.3	159.8	161.0	162.3
a) Noise Levels from Figure A3.1, where V _{mpd} = 160 kt TAS					
at 1250 ft MSR	EPNdB	-	87.18	87.34	87.51
at 1600 ft MSR	EPNdB	84.12	84.34	84.50	84.67
at 2000 ft MSR	EPNdB	81.63	-	-	-
b) Logarithmic interpolation to determine noise level at reference MSR					
	EPNdB	83.79	84.73	85.44	86.18
c) Speed Correction 10 Log (V _{mpd} /V _{ref})					
	EPNdB	0.05	0.00	-0.03	-0.06
d) Corrected EPNL - rounded					
	EPNdB	83.84	84.73	85.42	86.12
		83.8	84.7	85.4	86.1
e) 90% Confidence Interval +EPNdB (see Section A3.2 below)					
		0.18	0.19	0.19	0.20

3.2 90% CONFIDENCE INTERVALS

The 90% confidence interval curves for each parametric data line contributing to the take-off NPD are shown in Reference A3.1 Figures 12 and 13. From these, the 90% confidence interval values tabulated below have been derived.

MIN SLANT RANGE ft	CORRECTED NET THRUST X _{n/6} - lb/engine									
	2000	2500	3000	3500	4000	4500	5000	5500	6000	
	90% CONFIDENCE INTERVALS - ± EPNdB									
1250	0.50	0.31	0.22	0.22	0.23	0.22	0.19	0.20	0.31	
1600	0.41	0.26	0.18	0.18	0.19	0.19	0.16	0.17	0.26	
2000	0.40	0.25	0.18	0.17	0.18	0.18	0.16	0.16	0.25	
2500	0.42	0.26	0.19	0.18	0.20	0.19	0.17	0.17	0.26	

For all the take-off cases considered the 90% confidence intervals are + 0.2 EPNdB. This is well within the ± 1.5 EPNdB limits prescribed in BCAR Section N and FAR Part 36.

A3.1 R T HALE
R J WOODROW

ADE-ETA-C-463-AC2080, Bae 146 C of A Report No 137, 'Bae 146 Series 300 with LF507 Engines. Compliance with BCAR Section N Noise and with FAR Part 36 Noise Standards', February 1992

FLAPS 18 degree
UNDERCARRIAGE UP
25°C, 70%RH
AIRCRAFT SPEED - 160 knots TAS

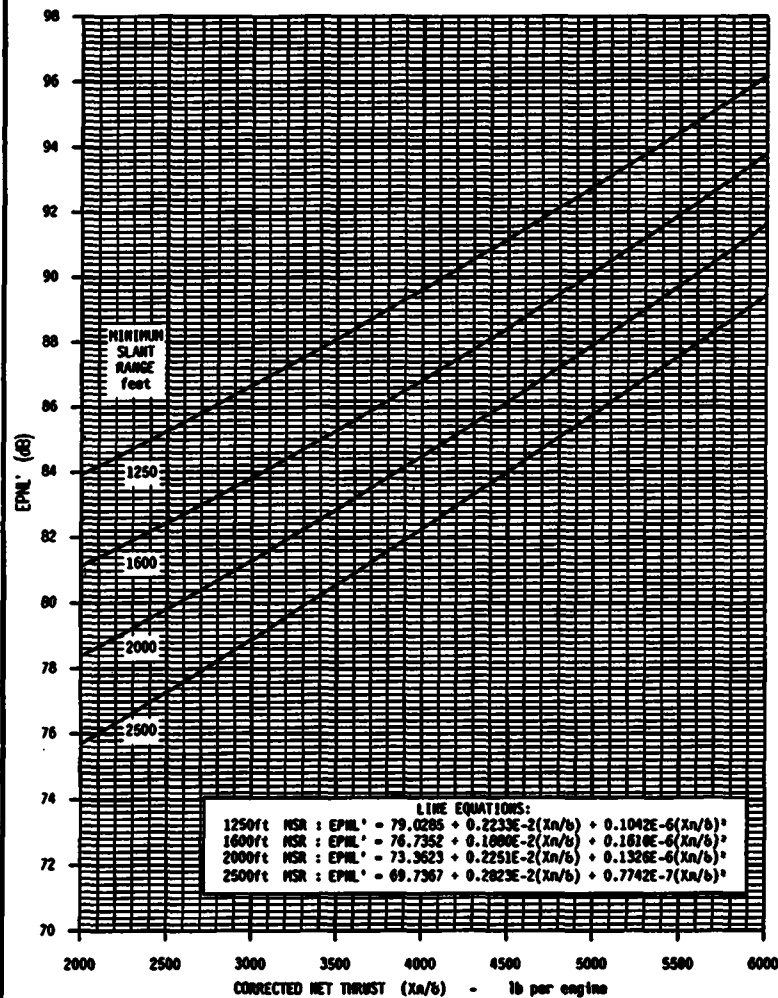


FIGURE A3.1 TAKE-OFF NPD CHART

APPENDIX 4

DERIVATION OF THE RJ100 'A' WEIGHTED NOISE LEVELS

This appendix derives the maximum 'A' weighted noise levels of the RJ100 aircraft under certification conditions for the take-off and approach positions. For take-off, the case considered is with cutback power. For approach, both landing flap settings and both airbrake positions have been included.

Although none of the regulations relating to the noise certification of subsonic jet aircraft demand any analysis in 'A' weighted decibels they are included in this report for validation by the certifying authorities. These levels are required by the FAA for their aircraft noise data bank, and for publication in their Advisory Circular AC36.3 when next it is updated. Validated 'A' weighted noise levels are also of use when assessing the acoustic performance of the aircraft in relation to noise regulations in the same metric which govern operations at certain airports.

CONTENTS

A4.1 CALCULATION PROCEDURE

- A4.1.1 Take-Off
A4.1.2 Approach

A4.2 90% CONFIDENCE INTERVALS

REFERENCES

TABLES

A4.1 'A' WEIGHTED NOISE LEVELS

- a) Phase 1 of Weight Development
b) Phase 2 of Weight Development
c) Phase 3 (Optional) of Weight Development
d) Phase 4 of Weight Development

FIGURE

A4.1 TAKE-OFF LAMax NPD CHART

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A4.1 CALCULATION PROCEDURE

The take-off L_{max} (maximum 'A' weighted noise level) NPD database was developed in Reference A4.1, Appendix 11 to the same standard of analysis as used for the certification EPNL levels. The take-off NPD chart is reproduced from Reference A4.1 as Figure A4.1. These have been used in conjunction with the reference flight profiles derived in Appendix 1 to calculate the L_{max} values and associated 90% confidence intervals presented in Tables A4.1(a) to (d). The methodology used is described below.

A4.1.1 Take-Off

The take-off NPD chart is presented in Figure A4.1 together with the equations of the least-squares quadratic regression lines for the four Minimum Slant Ranges (MSR) considered ie 1250, 1600, 2000 and 2500 ft. The values of L_{max} for the take-off position when using the cutback procedure have been derived from the NPD database using logarithmic interpolation.

The relevant aircraft flight parameters and interpolated values of L_{max} are presented in the following table together with the 90% confidence intervals for the four maximum take-off weights under consideration.

MTOW	lb	95000	97500	99500	101500
Height @ 21325 ft from SOR	ft	1650	1548	1475	1405
MSR	ft	1649	1547	1474	1403
Corr. Net Thrust (X _n /6)	lb/eng	3105	3178	3233	3293
a) L _{max} Levels from Figure A3.1,					
at 1250 ft MSR	dB(A)	-	76.80	76.93	77.08
at 1600 ft MSR	dB(A)	73.67	73.85	73.98	74.13
at 2000 ft MSR	dB(A)	70.92	-	-	-
b) Logarithmic interpolation to determine L _{max}					
at reference MSR	dB(A)	73.30	74.25	74.97	75.70
- rounded	dB(A)	73.3	74.3	75.0	75.7
c) 90% Confidence Interval +dB(A)					
(see Section A5.2 below)		0.2	0.2	0.2	0.2

A4.1.2 Approach

For the approach cases under consideration, the RJ100 operates in an identical manner to the Series 300. Therefore, the RJ100 approach L_{max} values will be the same as those presented in Reference A4.1 Appendix 11. These values have been included in Tables A4.1 (a) to (d) for completeness.

A4.2 90% Confidence Intervals

The 90% confidence interval values quoted above have been derived by interpolating the 90% confidence interval data presented in Reference A4.1 Appendix 11.

REFERENCES

A4.1 R T HALE
R J WOODROW

ADE-ETA-C-463-AC2080; BAe 146 C of A Report No 137 'BAe 146 Series 300 with LF507 Engines. Compliance with ECAR Section N Noise and with FAR Part 36 Noise Standards,' February 1992

TABLE A4.1(a) - PHASE 1 OF WEIGHT DEVELOPMENT		
Maximum take-off weight lb (kg) 95000 (43091) Maximum landing weight lb (kg) 83000 (37648)		
POSITION	CORRECTED L _{Amax} dB(A)	90% CONFIDENCE INTERVAL
TAKE-OFF - with cutback	73.3	+0.2
APPROACH		
(i) 33 deg flap: airbrake OPEN	87.2	+0.2
airbrake CLOSED	85.7	+0.2
(ii) 24 deg flap: airbrake OPEN	85.5	+0.1
airbrake CLOSED	84.2	+0.1

TABLE A4.1(b) - PHASE 2 OF WEIGHT DEVELOPMENT		
Maximum take-off weight lb (kg) 97500 (44225) Maximum landing weight lb (kg) 84500 (38328)		
POSITION	CORRECTED L _{Amax} dB(A)	90% CONFIDENCE INTERVAL
TAKE-OFF - with cutback	74.3	+0.2
APPROACH		
(i) 33 deg flap: airbrake OPEN	87.3	+0.2
airbrake CLOSED	85.8	+0.2
(ii) 24 deg flap: airbrake OPEN	85.6	+0.1
airbrake CLOSED	84.2	+0.1

TABLE A4.1 - 'A' WEIGHTED NOISE LEVELS

TABLE A4.1(c) - PHASE 3 (OPTIONAL) OF WEIGHT DEVELOPMENT		
Maximum take-off weight lb (kg) 99500 (45132) Maximum landing weight lb (kg) 86500 (39235)		
POSITION	CORRECTED L _{Amax} dB(A)	90% CONFIDENCE INTERVAL
TAKE-OFF - with cutback	75.0	+0.2
APPROACH		
(i) 33 deg flap: airbrake OPEN	87.4	+0.2
airbrake CLOSED	85.9	+0.2
(ii) 24 deg flap: airbrake OPEN	85.7	+0.1
airbrake CLOSED	84.3	+0.1

TABLE A4.1(d) - PHASE 4 OF WEIGHT DEVELOPMENT		
Maximum take-off weight lb (kg) 101500 (46089) Maximum landing weight lb (kg) 88500 (40142)		
POSITION	CORRECTED L _{Amax} dB(A)	90% CONFIDENCE INTERVAL
TAKE-OFF - with cutback	75.7	+0.2
APPROACH		
(i) 33 deg flap: airbrake OPEN	87.6	+0.2
airbrake CLOSED	86.0	+0.2
(ii) 24 deg flap: airbrake OPEN	85.8	+0.1
airbrake CLOSED	84.4	+0.1

TABLE A4.1 - 'A' WEIGHTED NOISE LEVELS (CONTINUED)

1000BA.XLS Chart 1

FLAPS 18 degree
UNDERCARRIAGE UP
25°C, 70%RH
AIRCRAFT SPEED - 160 knots TAS

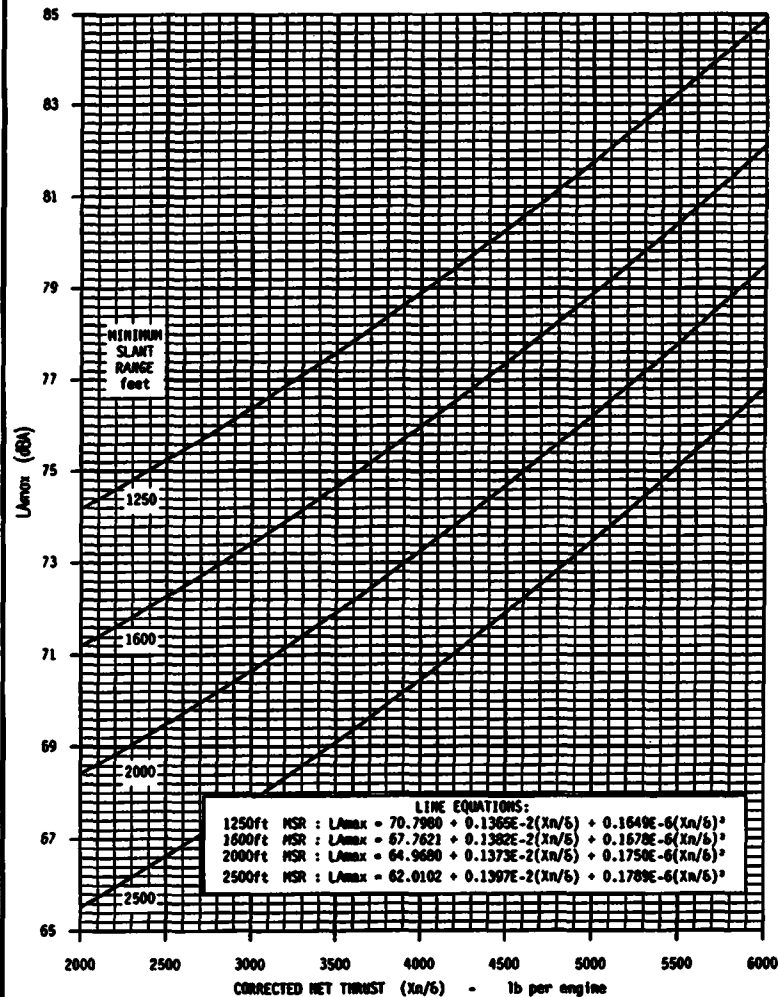


FIGURE A4.1 TAKE-OFF L_{max} NPD CHART

BRITISH AEROSPACE PLC - MANCHESTER
REPORT DOCUMENTATION PAGE

1. REFERENCE NUMBER ADE-EFE-C-463-AC0260		2. SECURITY CLASSIFICATION	
3. ORIGINATOR (LOCATION AND DEPARTMENT) ENGINEERING TEST FACILITIES - BRITISH AEROSPACE, REGIONAL AIRCRAFT LTD, WOODFORD			
4. TITLE AVRO 146-RJ100 WITH LF507-1F ENGINES COMPLIANCE WITH BCAR SECTION N NOISE AND WITH FAR PART 36 NOISE STANDARDS SUPPLEMENT No 3 TO Bae 146 C OF A REPORT No 137			
5. PRESENTED AT (FOR CONFERENCE PAPERS)			
6. AUTHOR 1 J F EVERS	7. AUTHOR 2	8. AUTHOR 3	9. DATE JUNE 1993
10. PP ref 68 5	11. CONTRACT NO:	12. PROJECT	
13. OTHER REFERENCE (CENTRAL INDEX)		14. FURTHER REFERENCE	
15. DESCRIPTORS NOISE, CERTIFICATION			
16. ABSTRACT This report demonstrates compliance of the AVRO 146-RJ100 aircraft powered by LF507-1F engines with the noise requirements of BCAR Section N Noise and with FAR Part 36. Maximum take-off and landing weights are covered up to the Phase 4 weight development.			
17. FOR LIBRARY USE			
18. DISTRIBUTION CATEGORY		19. AUTHORITY	

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1st June 2015

Our Reference: FOS/SM/37/2015

BAE Systems AVRO RJ100 Supplementary Data to Noise Certification Data.

Dear Sir.

With reference to your recent request, please find in this letter details of the noise characteristics for the Avro 146-RJ100 aircraft powered by four Honeywell (Textron) LF507-1F turbofan engines. The noise levels stated in the Aircraft Flight Manual (AFM 5.1 section 6-040-10) and below comply with ICAO Annex 16, Volume 1, Chapter 3 noise requirements (which is equivalent to CS Amendment 3).

The CAA/FAA approved noise certification levels for this aircraft / engine at a Maximum Take-Off Weight (MTOW) of 44225 kg and a Maximum Landing Weight (MLW) of 40142 kg are presented below together with the noise certification limits named above. All noise levels are EPNdB.

POSITION	NOISE LIMIT	Certification Noise level at 44225 kg MTOW	Certification Noise level at 43091 kg MTOW
Sideline	94.9	88.2	88.3
Take-Off			
(i) No Cutback	93.5	89.4	88.8
(ii) With Cutback	93.5	84.7	83.8

For the approach the noise limit is 98.8 EPNdB and the noise certification level refers to the noisiest approach configuration as required by the certification requirements, which for the RJ100 is 33 deg flap setting with airbrakes 'OPEN'

Approach Noise Certification Levels In EPNdB - Various Landing Weights			
	38329 kg	39236 kg	40142 kg
Flap 33 Airbrakes 'OPEN' 3 degree glideslope	97.3	97.4	97.6

Alternative approach configurations are 33 and 24 deg flap setting with airbrakes 'CLOSED', with, where permissible, a 3.5 degree glideslope angle. These reduce the noise levels under approach conditions to the levels shown below.

Approach Noise Certification Levels In EPNdB - Various Landing Weights			
	38329 kg	39236 kg	40142 kg
Flap 33 Airbrakes 'CLOSED' 3.5 deg glideslope	94.0	94.0	94.1
Flap 24 Airbrakes 'CLOSED' 3.5 deg glideslope	91.5	91.5	91.5

The sideline and take-off (with cutback) noise certification levels can be combined with the 3.5 deg glideslope approach noise level to show that the RJ100 can meet the 89 EPNdB Bromma noise limit (average of the sideline, take-off and approach noise levels) at the highest weights of MTOW 44225 kg and MLW 40142 kg.

This is illustrated in the following table at the MTOW and a reduced TOW of 43091 Kg and at the MLW and reduced LWs of 39236 and 38329 kg.

Bromma Average EPNdB of Sideline, Take-off with Cutback and Approach on 3.5 deg Glideslope							
TOW kg	LW kg	Sideline Noise level	Take-off with cutback	Approach 33 deg flap A/B closed	Approach 24 deg flap A/B closed	Bromma Average 33 flap land	Bromma Average 24 flap land
44225	38329	88.2	84.7	94.0	91.5	89.0	88.1
44225	39236	88.2	84.7	94.0	91.5	89.0	88.1
44225	40143	88.2	84.7	94.1	91.5	89.0	88.1
43091	38329	88.3	83.8	94.0	91.5	88.7	87.9
43091	39236	88.3	83.8	94.0	91.5	88.7	87.9
43091	40143	88.3	83.8	94.1	91.5	88.7	87.9

This letter therefore provides information to support that the RJ100 when approaching with a 3.5 degree glideslope and airbrakes closed does operate within the 89 EPNdB average noise requirement at Bromma Airport.

Yours Sincerely,

Stephen Morrison

Mr Stephen Morrison
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Our Reference: FOS/SM/31A/2015

BAE Systems AVRO RJ85 Supplementary Data to Noise Certification Data.

Dear Sir.

With reference to your recent request, please find in this letter details of the noise characteristics for the Avro 146-RJ85 aircraft powered by four Honeywell (Textron) LF507-1F turbofan engines. The noise levels stated in the Aircraft Flight Manual (AFM 5.1 section 6-040-10) and below comply with ICAO Annex 16, Volume 1, Chapter 3 noise requirements (which is equivalent to CS Amendment 3).

The CAA/FAA approved noise certification levels for this aircraft / engine at a Maximum Take-Off Weight (MTOW) of 43998 kg and a Maximum Landing Weight (MLW) of 38555 kg are presented below together with the noise certification limits named above. All noise levels are EPNdB.

POSITION	NOISE LIMIT	Certification Noise level at 43998 kg MTOW	Certification Noise level at 42184 kg MTOW
Sideline	94.9	88.4	88.6
Take-Off			
(i) No Cutback	93.5	89.2	88.4
(ii) With Cutback	93.5	84.3	83.0

For the approach the noise limit is 98.8 EPNdB and the noise certification level refers to the noisiest approach configuration as required by the certification requirements, which for the RJ85 is 33 deg flap setting with airbrakes 'OPEN'

Approach Noise Certification Levels In EPNdB - Various Landing Weights			
	35153 kg	36741 kg	38555 kg
Flap 33 Airbrakes 'OPEN' 3 degree glideslope	96.9	97.1	97.3

Alternative approach configurations are 33 and 24 deg flap setting with airbrakes 'CLOSED', with, where permissible, a 3.5 degree glideslope angle. These reduce the noise levels under approach conditions to the levels shown below.

Approach Noise Certification Levels In EPNdB - Various Landing Weights			
	35153 kg	36741 kg	38555 kg
Flap 33 Airbrakes 'CLOSED' 3.5 deg glideslope	93.5	93.6	93.8
Flap 24 Airbrakes 'CLOSED' 3.5 deg glideslope	91.6	91.6	91.7

$$\begin{array}{r}
 \text{komb} \\
 88.4 + 93.3 + 93.8 \\
 \hline
 3 \\
 = 88.833
 \end{array}$$

The sideline and take-off (with cutback) noise certification levels can be combined with the 3.5 deg glideslope approach noise level to show that the RJ85 can meet the 89 EPNdB Bromma noise limit (average of the sideline, take-off and approach noise levels) at the highest weights of MTOW 43998 kg and MLW 38555 kg.

This is illustrated in the following table at the MTOW and a reduced TOW of 42184 Kg and at the MLW and reduced LWs of 36741 and 35153 kg.

Bromma Average EPNdB of Sideline, Take-off with Cutback and Approach on 3.5 deg Glideslope							
TOW kg	LW kg	Sideline Noise level	Take-off with cutback	Approach 33 deg flap A/B closed	Approach 24 deg flap A/B closed	Bromma Average 33 flap land	Bromma Average 24 flap land
43998	35153	88.4	84.3	93.5	91.6	88.7	88.1
43998	36741	88.4	84.3	93.6	91.6	88.8	88.1
43998	38555	88.4	84.3	93.8	91.7	88.8	88.1
42184	35153	88.6	83.0	93.5	91.6	88.3	87.7
42184	36741	88.6	83.0	93.6	91.6	88.4	87.7
42184	38555	88.6	83.0	93.8	91.7	88.4	87.7

This letter therefore provides information to support that the RJ85 when approaching with a 3.5 degree glideslope and airbrakes closed does operate within the 89 EPNdB average noise requirement at Bromma Airport.

Yours Sincerely,

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