Open Skies Treaty Certification

Part I: Mission Summary

State Party Conducting the Certification		United States		
Aircraft Type and Model		OC-135B/61-2672		
Sensor	Type and Model	KS-87E		
	Installation	INT-5-L-52		
	Configuration Number	US-OF__-3010		
	Serial Number	1002		
	Depression Angle (degrees)	52		
Lens	Type	Pacific Optical / Recon Optical		
	Focal Length in millimeters	152.4		
	Maximum Aperature	f2.8		
	Serial Number	1005		
Scan Angles / Field of View		41		
Shutter Speeds		1/60-1/1500		
Type of Filter		WRATTEN #25		
Type of Film		3404	Roll Number	1
Velocity / Height Setting		Automatic		
Active frame center to edge (millimeters)		57.15		
Date of In-Flight Examination		5/11/2002		
Take-off Time	14:45 GMT	Landing Time	19:35 GMT	
Target Location	WPAFB	Target Lat / Long	39 46 35 N / 84 07 03 E	
Target Angle (degrees)		0		
Film Processing Information	Film Speed (ISO A)	150		
	Average Gradient (G-Bar)	0.94		
	Developer Temp (^{o} F)	104		
	Transport Speed (ft/min)	21.5		
Speed / Color		8		
Percent Overlap		Max		

OS2554	US-OF__-3010	
H min	**H** min Expected	Difference With **H** min Expected
2535 Meters	2801 Meters	-9%

Part II: Minimum Height Summary Configuration: US-OF__-3010

KS-87E	3404	WRATTEN #25

Pass Number	H_{min}	H_{min} Expected	Difference With H_{min} Expected
1	2753		
2	2397		
3	2497		
4	2508		
5	2520		
Total	12675.2		
Average	2535		
Standard Deviation	118		
H_{min}	**2535**	**2801**	**-9%**

	Pass Number	1	2	3	4	5
	Frame Number	254	275	292	310	327
H_i	The height of the aircraft the moment the calibration target was photographed (met	2810	2797	2800	2800	2798
L_a	The agreed ground resolution (cm)	30				
L_2	Ground resolution based on the 80th-percentile rule	23.02	26.21	25.2	25.26	24.92
K_1	The agreed modulation at which ground resolution is defined	0.4				
K_2	The effective modulation from paragraph (C)	0.754	0.761	0.76	0.749	0.762
m	The agreed corrected exponent	0.45				
H_{min}	$= H_i \times \frac{L_a}{L_2} \times \frac{K_1}{K_2}^{m}$	2753	2397	2497	2508	2520

(A) Calculation of the height above ground level at which the optical camera would achieve a ground resolution of 30cm against a target which has the agreed modulation of 0.4 or equivalent contrast ratio of 2.3 to 1 against its background.

Part III: Ground Resolution

(B) Determination of the ground resolution of the optical camera at the altitude from which the calibration target was photographed, from a visual analysis of the image of the calibration target on the original film negative. The value of the ground resolution shall be equal to the width of a single bar in the smallest group of bars which can be distinguished as separate bars, in centimeters.

Widest Group Number	1
Size of Largest Group (cm)	75.6

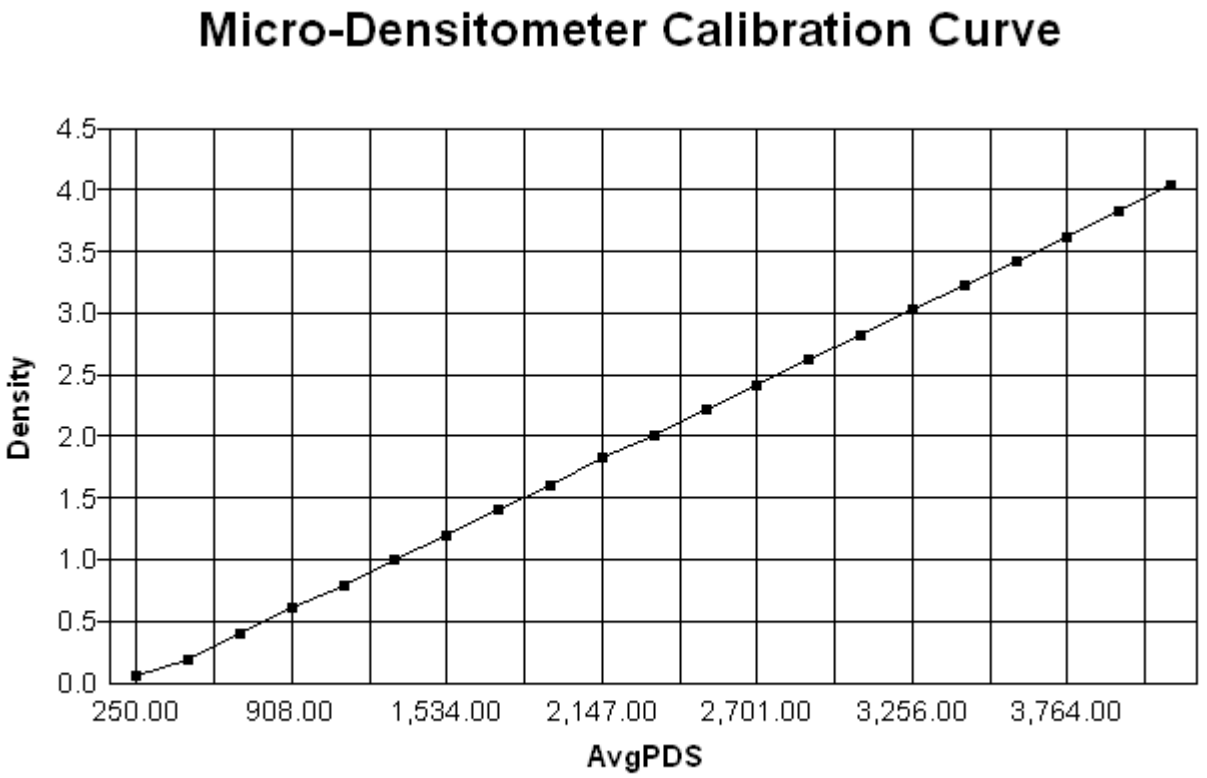
Narrowest Group Number	23
6th Root of 2 Progression	1.1225

Group	1	2	3	4	5	6	7	8	9	10
Width	75.6	67.4	60	53.5	47.6	42.4	37.8	33.7	30	26.7
Group	11	12	13	14	15	16	17	18	19	20
Width	23.8	21.2	18.9	16.8	15	13.4	11.9	10.6	9.5	8.4
Group	21	22	23							
Width	7.5	6.7	6							
Group										
Width										

Cloud Cover	0	percent	0	percent	0	percent	0	percent	0	percent
Modulation (K2)	0.754		0.761		0.76		0.749		0.762	
Aircraft Pass	1		2		3		4		5	
Target Zone	4		4		3		3		3	
Target Location	10	mm	13	mm	15	mm	5	mm	11	mm
Time	1610	gmt	1618	gmt	1626	gmt	1635	gmt	1643	gmt
Altitude (AGL)	2810	meters	2797	meters	2800	meters	2800	meters	2798	meters
Ground Speed	691 KM	km/hr	676 KM	km/hr	687 KM	km/hr	682 KM	km/hr	6790 KM	km/hr
Drift	1.02 L	degrees	0.91 L	degrees	0.90 L	degrees	1.07 L	degrees	1.02 L	degrees
Roll	0.04 R	degrees	0.05 R	degrees	1.04 L	degrees	2.01 R	degrees	0.41 R	degrees
Pitch	0.86 U	degrees	1.11 U	degrees	0.85 U	degrees	0.77 U	degrees	0.93 U	degrees
Field of View	41	degrees	41	degrees	41	degrees	41	degrees	41	degrees
Frame Number	254		275		292		310		327	
Kp	0.821		0.811		0.803		0.838		0.818	
Lp/mm	40.05	19.84	35.01	19.28	36.45	19.3	36.37	21.34	36.84	18.99
Observers	AL Width (cm	AC Width (cm	AL Width (cm	AC Width (cm	AL Width (cm	AC Width (cm	AL Width (cm	AC Width (cm	AL Width (cm	AC Width (cm
Andrianov, Oleg	19.54	47.6	24.33	47.6	24.09	47.6	22.37	42.4	21.84	47.6
Breuer	24.63	47.6	27.33	47.6	27.06	47.6	28.24	42.4	24.54	47.6
Goerling, Philip	21.92	53.5	27.33	47.6	24.09	47.6	22.37	47.6	24.54	53.5
HONNAY	19.54	30	27.33	47.6	27.06	47.6	22.37	42.4	24.54	47.6
Lane, Bruce A.	24.63	53.5	27.33	53.5	27.06	47.6	28.24	42.4	27.57	60
Lipchenko	19.54	37.8	24.33	47.6	24.09	42.4	28.24	37.8	24.54	47.6
Marzeda, Pawel	24.63	42.4	24.33	42.4	24.09	47.6	25.14	42.4	24.54	47.6
Millotti, Pier	24.63	47.6	24.33	47.6	24.09	47.6	22.37	42.4	24.54	47.6
Molnar, Emilia	24.63	47.6	27.33	47.6	24.09	47.6	25.14	42.4	24.54	47.6
Simonsen, Kjell	27.67	47.6	34.39	47.6	30.35	47.6	31.68	47.6	27.57	47.6
Trimmean (cm)	23.02	46.46	26.21	47.6	25.2	47.6	25.26	43.05	24.92	48.34
L2	23.02	cm	26.21	cm	25.2	cm	25.26	cm	24.92	cm
Crab Angle	4	degrees	4	degrees	3	degrees	4	degrees	4	degrees

Part IV: Micro-Densitometer Calibration

File	Step	# Pts	Avg PDS	Std Dev	Density
NBS01.IMG	1	1681	250	23.16	0.06
NBS02.IMG	2	1681	477	28.67	0.19
NBS03.IMG	3	1681	703	30.67	0.40
NBS04.IMG	4	1681	908	35.45	0.60
NBS05.IMG	5	1681	1118	39.58	0.80
NBS06.IMG	6	1681	1328	44.13	1.00
NBS07.IMG	7	1681	1534	44.41	1.20
NBS08.IMG	8	1681	1741	48.79	1.40
NBS09.IMG	9	1681	1955	53.03	1.60
NBS10.IMG	10	1681	2147	60.05	1.83
NBS11.IMG	11	1681	2329	59.16	2.01
NBS12.IMG	12	1681	2521	58.18	2.22
NBS13.IMG	13	1681	2701	53.30	2.42
NBS14.IMG	14	1681	2890	50.60	2.62
NBS15.IMG	15	1681	3082	43.82	2.82
NBS16.IMG	16	1681	3256	36.70	3.03
NBS17.IMG	17	1681	3421	28.77	3.23
NBS18.IMG	18	1681	3581	26.02	3.42
NBS19.IMG	19	1681	3764	21.12	3.61
NBS20.IMG	20	1681	3953	17.53	3.82
NBS21.IMG	21	1681	4095	3.27	4.04



Part V: PDS Sensitometric Strip Measurements

PDS Head Measurements

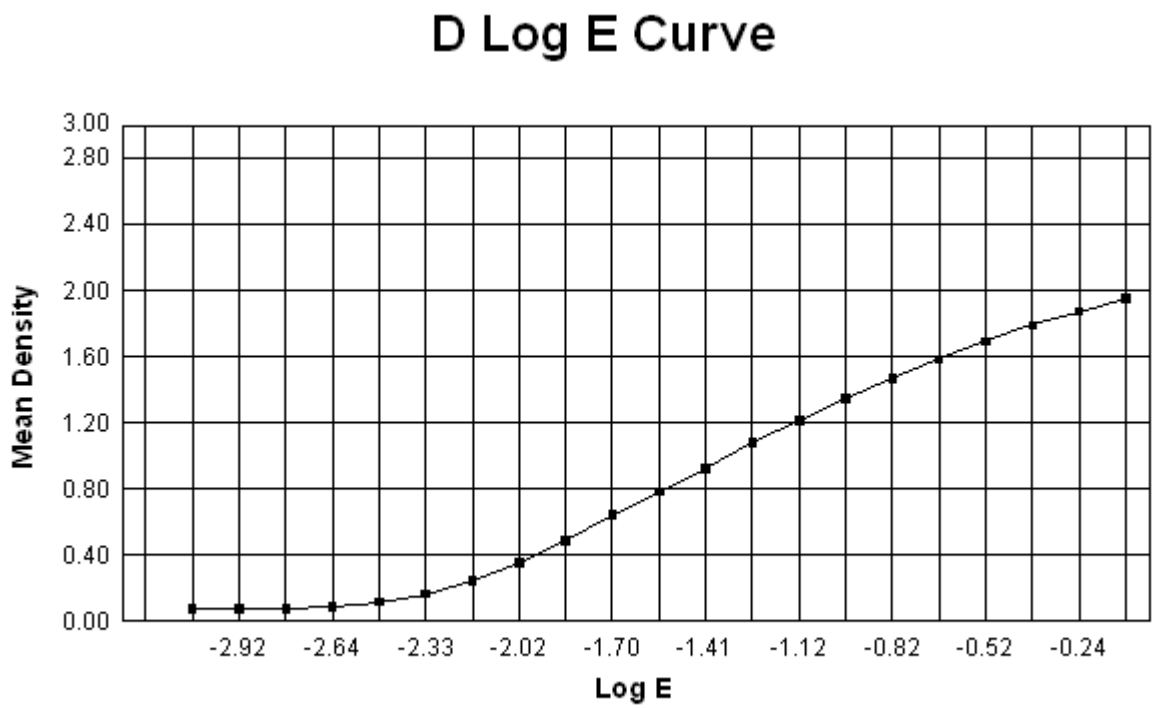
File	Step	NumPts	AvgPDS	StdDev	Density
HEAD00.IMG	1.00	1681	124	16.75	0.08
HEAD01.IMG	2.00	1681	127	17.01	0.08
HEAD02.IMG	3.00	1681	130	20.21	0.09
HEAD03.IMG	4.00	1681	145	18.53	0.10
HEAD04.IMG	5.00	1681	172	22.44	0.12
HEAD05.IMG	6.00	1681	224	23.51	0.17
HEAD06.IMG	7.00	1681	313	26.13	0.25
HEAD07.IMG	8.00	1681	433	29.01	0.36
HEAD08.IMG	9.00	1681	580	32.13	0.49
HEAD09.IMG	10.00	1681	753	34.74	0.65
HEAD10.IMG	11.00	1681	895	36.84	0.78
HEAD11.IMG	12.00	1681	1044	37.43	0.92
HEAD12.IMG	13.00	1681	1199	39.96	1.07
HEAD13.IMG	14.00	1681	1336	42.50	1.20
HEAD14.IMG	15.00	1681	1477	43.06	1.34
HEAD15.IMG	16.00	1681	1601	44.19	1.47
HEAD16.IMG	17.00	1681	1714	47.92	1.58
HEAD17.IMG	18.00	1681	1822	47.45	1.69
HEAD18.IMG	19.00	1681	1918	50.49	1.79
HEAD19.IMG	20.00	1681	1996	50.31	1.87
HEAD20.IMG	21.00	1681	2072	47.04	1.95
HEAD21.IMG	B+F	1681	122	19.78	0.08

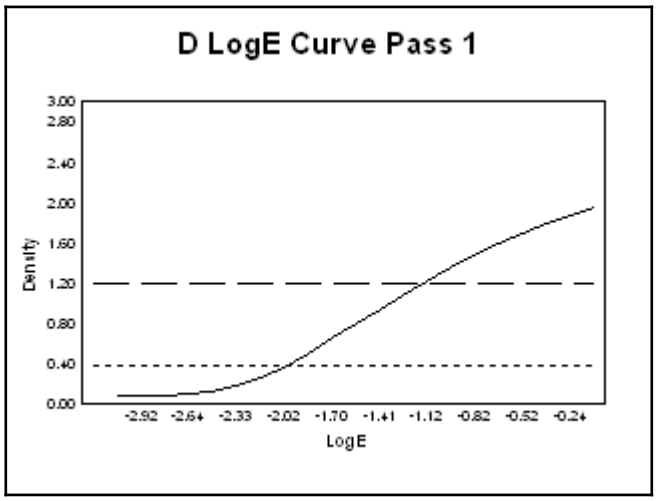
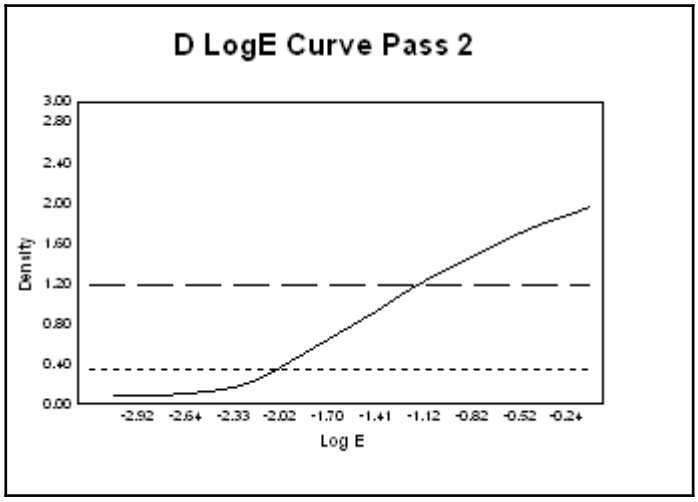
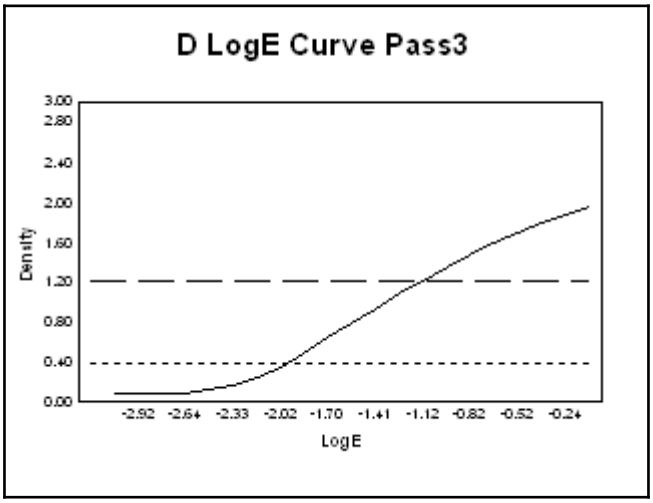
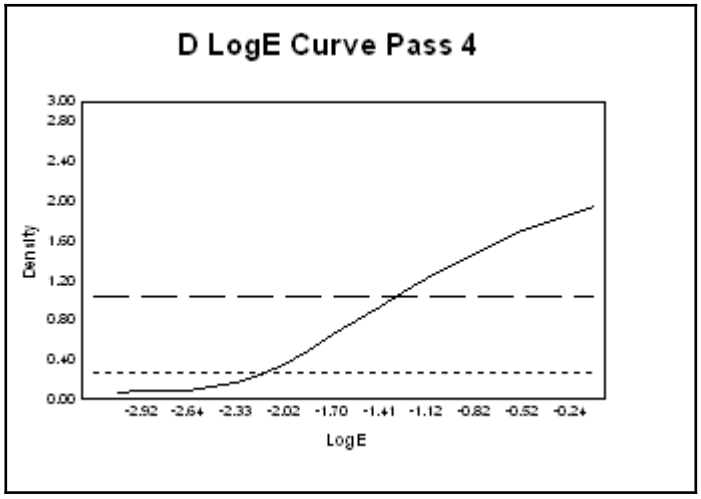
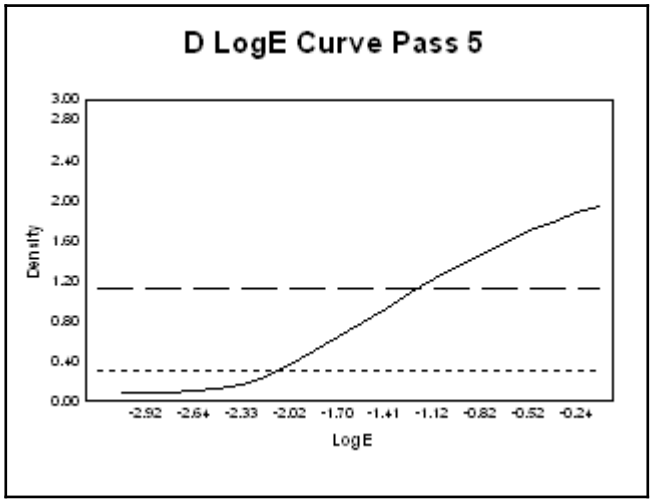
PDS Tail Measurements

File	Step	NumPts	AvgPDS	StdDev	Density
TAIL00.IMG	1.00	1681	106	18.75	0.07
TAIL01.IMG	2.00	1681	110	24.68	0.07
TAIL02.IMG	3.00	1681	114	16.10	0.07
TAIL03.IMG	4.00	1681	128	18.09	0.08
TAIL04.IMG	5.00	1681	158	20.33	0.11
TAIL05.IMG	6.00	1681	215	23.34	0.16
TAIL06.IMG	7.00	1681	309	26.73	0.24
TAIL07.IMG	8.00	1681	428	28.98	0.35
TAIL08.IMG	9.00	1681	582	31.51	0.49
TAIL09.IMG	10.00	1681	753	35.46	0.65
TAIL10.IMG	11.00	1681	904	36.30	0.79
TAIL11.IMG	12.00	1681	1056	38.71	0.93
TAIL12.IMG	13.00	1681	1221	40.37	1.09
TAIL13.IMG	14.00	1681	1355	43.37	1.22
TAIL14.IMG	15.00	1681	1489	43.44	1.35
TAIL15.IMG	16.00	1681	1605	45.71	1.47
TAIL16.IMG	17.00	1681	1731	47.33	1.60
TAIL17.IMG	18.00	1681	1838	50.25	1.71
TAIL18.IMG	19.00	1681	1929	49.61	1.80
TAIL19.IMG	20.00	1681	2011	51.02	1.88
TAIL20.IMG	21.00	1681	2088	50.39	1.96
TAIL21.IMG	B+F	1681	107	16.17	0.07

Part VI: D log E Plot

Step	LogE	Head Density	Tail Density	Mean Density
1.00	-3.07	0.08	0.07	0.07
2.00	-2.92	0.08	0.07	0.08
3.00	-2.78	0.09	0.07	0.08
4.00	-2.64	0.10	0.08	0.09
5.00	-2.48	0.12	0.11	0.12
6.00	-2.33	0.17	0.16	0.17
7.00	-2.17	0.25	0.24	0.25
8.00	-2.02	0.36	0.35	0.35
9.00	-1.86	0.49	0.49	0.49
10.00	-1.70	0.65	0.65	0.65
11.00	-1.56	0.78	0.79	0.79
12.00	-1.41	0.92	0.93	0.93
13.00	-1.26	1.07	1.09	1.08
14.00	-1.12	1.20	1.22	1.21
15.00	-0.96	1.34	1.35	1.35
16.00	-0.82	1.47	1.47	1.47
17.00	-0.67	1.58	1.60	1.59
18.00	-0.52	1.69	1.71	1.70
19.00	-0.38	1.79	1.80	1.79
20.00	-0.24	1.87	1.88	1.87
21.00	-0.10	1.95	1.96	1.95
B+F		0.08	0.07	0.07



Part VII: Average Density of Bar and Space & Effective Modulation K2

Frame	Pass	Black				White				*Delta*= (LogE $_{Black}$ -LogE $_{White}$)	C=10^{Delta} Contrast	K2= $\frac{C-1}{C+1}$ K2
		Samples	Density	StdDev	LogE	Samples	Density	StdDev	LogE			
254	1	143	1.18	0.03	-1.41	143	0.37	0.03	-2.26	0.85	7.12	0.75
275	2	143	1.18	0.04	-1.42	143	0.35	0.03	-2.29	0.87	7.38	0.76
292	3	143	1.21	0.04	-1.39	143	0.38	0.03	-2.25	0.87	7.34	0.76
310	4	143	1.05	0.03	-1.55	143	0.27	0.03	-2.40	0.84	6.97	0.75
327	5	143	1.11	0.03	-1.49	143	0.30	0.03	-2.36	0.87	7.41	0.76