Appendix D-3

MODELED AIRCRAFT OPERATIONS FOR NOISE ASSESSMENT OF YEAR 2010

APPENDIX D-3

Modeled Aircraft Operations for Noise Assessment of Year 2010

The data used in this EIS are derived from a number of sources including, but not limited to, records maintained by IAD and FAA. Specific sources are identified for each input requirement. **Appendix D-3** contains information that is common to all scenarios for Year 2010 (i.e., No-Action, Build Alternatives 1, 3, and 4, and the Interim Construction Scenarios). Data that is specific to each scenario is presented in **Appendices D-4 through D-9**.

Weather and Climate – The weather and climate conditions for IAD are described in **Appendix D-2**. The INM default values for temperature (57.9°Farenheit), pressure (29.92 inches of mercury), humidity (70%), and headwind (8 knots) were used to model noise levels for all alternatives at IAD in 2010. The default airport temperature is computed using the International Standard Atmosphere (ISA) equation for "standard-day" temperature versus altitude. ISA temperature is 59°F at mean sea level, and it gets progressively colder at higher airport elevations. The default airport pressure is 29.92 inches of mercury at all airport elevations because atmospheric pressure is referred to sea level. The default average headwind is 8 knots, which is the value used in the SAE-AIR 1845 equations. INM uses temperature, pressure, and headwind when computing procedural profiles. Humidity is only used in calculating atmospheric absorption.

Activity Levels and Fleet Mix – As shown in **Table D-3.1**, the forecasted total number of aircraft operations for IAD for Year 2010 would be 568,411. This total is based on the Updated Activity Forecasts (HNTB, 2003). The annual average daily number of aircraft operations, were the basis for developing noise contours for the 2010 Alternatives. The total of **Table D-3.1** corresponds to 1,557 annual average daily aircraft operations.

The make and model of aircraft used in these operations were also identified for the development of a fleet mix. Fleet mix refers to the various types of aircraft operating at IAD and included very specific information such as engine type, FAR Part 36 Noise Stage Certification, gross weight, and departure stage length. See the Flight Profiles and Performance Data section below for discussion of stage length. As fleet mix and aircraft operations data were derived, four groups of IAD users similar to ATCT counts were established: Air Passenger, Cargo, General Aviation (GA)/Air Taxi, and Military. Each identified aircraft type in each user group was assigned to an aircraft category. The aircraft categories for each group are listed in **Table D-3.1**.

The operation numbers and fleet mix for the 2010 Condition were developed from the Forecast's Table 5. To be consistent with the Forecast's average weekday peak month (AWDPM) schedule (Forecast's Appendix D) and to account for its unique day-night mix, Cargo operations were separated from the Forecast's Wide-body Jet, Narrow-body Jet and Commercial Turboprop operations[1]. In general, each aircraft type in the Forecast's Table 5 was assigned to a (single) representative INM aircraft type. The assignment for Wide-body Jet, Narrow-body Jet, Regional Jet and Commercial Turboprop was primarily

[1] It was not necessary to separate Cargo operations for the existing condition as their unique day-night mix was already incorporated into the source data.

based on national trends except for Cargo, which was operator-specific. The generic aircraft designation "320" was distributed among INM's A32023 and A320 types with the distribution from the existing conditions. The GA/Air Taxi operations were distributed among the same INM aircraft types in the existing (2002) condition with the same percentages of operations. The Military operations were distributed among the two specific jet INM types and one turboprop INM type consistent with the fleet mix found in the Forecast's Appendix D. Application of the fleet mix to the average-daily aircraft operations figures produced the number of average-daily operations by aircraft type.

Tables D-3.2 through D-3.5 list the annual departure and arrival operations by representative INM aircraft type for each of the four groups. The operations information shown on these tables was used as input data to the INM for the 2010 Condition at IAD.

The distribution of flight operations among daytime (7am – 10pm) and nighttime (10pm – 7am) periods ("day-night mix") was based on Tables 6 and 7 of the Forecast, i.e., hourly distributions of AWDPM operations for arrival and departures, respectively. The Air Passenger flight operations were assigned the Passenger day-night mix (91% daytime for arrivals, 94% daytime for departures). The Cargo flight operations were assigned the Cargo day-night mix (21% daytime). The GA/Air Taxi flight operations were assigned the combination of GA and Air Taxi day-night mixes (86% daytime) and the Military flight operations were assigned the Military day-night mix (100 percent daytime).

Flight Profiles and Performance Data – INM contains reference noise and performance data on nearly all aircraft types operating at IAD, including aircraft equipped with hushkits. Aircraft manufacturers provide the data to the FAA. The data are used to develop aircraft departure and arrival flight profiles, and resultant noise exposure. Aircraft not specifically included in the database are modeled using appropriate substitution aircraft per the FAA's pre-approved substitution list.

Flight profiles calculate the vertical paths of aircraft during departure and arrival to determine the altitude, speed, and engine thrust or power of an aircraft at any point along a flight track. INM uses this information to calculate noise exposure on the ground. Profiles are unique to each aircraft type and are based on user (e.g., airline) operation procedures, temperature, and aircraft weight.

Standard INM departure profiles were used in this document. Departing aircraft were modeled beginning with takeoff roll, and ending when the aircraft reached an altitude of 10,000 feet above field elevation. The INM aircraft database contains departure flight profiles for each aircraft type, grouped by stage length. Stage length is a term used in airport planning and noise modeling referring to the distance in Nautical Air Miles (NM) to the destination airport. INM assumes each aircraft type's weight increases with stage, or trip length, due to the need for more fuel, and also assumes each aircraft type's takeoff distance and climb performance is different for each stage length. Heavy (long trip, high stage length) aircraft have increased takeoff distances and lower climb rates than lighter (short trip) aircraft, for a given aircraft type. Stage lengths are indexed according to the range of trip length. As shown in **Appendix D-2, Table D-2.10**, indices range from 1 through 7 for trip ranges of 500 NM to more than 4,500 NM, respectively. **Tables D-3.2 through D-3.5** showed the distribution of departures by stage length.

The distribution of Air Passenger and Cargo departure operations among stage lengths was based on the destinations of the Forecast's Year 2010 AWDPM schedule (event file) found in Appendix D of the Forecast. As using non-standard profiles was not within the scope of this study and because INM does not contain stage lengths other than stage length 1 for GA aircraft, GA/Air Taxi departure operations were constrained to stage length 1 (up to 500 nautical mile trip length). Identical to existing conditions, the distribution of Military jet departure operations among stage lengths was based on the resultant stage length distribution of all Air Passenger Wide-body Jets. Similarly, the distribution of Military turboprop operations among stage lengths were constrained to stage length 1 for the same reason provided above for the GA aircraft.

Arriving aircraft are not modeled with stage lengths as these aircraft consume most of their fuel during the flight, and land at typical landing weights. INM has a database of standard arrival flight profiles for each INM aircraft type. In accordance with FAA Order 1050.1E, arriving aircraft were modeled beginning at an altitude of 7,000 feet above field elevation and ending with the aircraft touchdown and roll-out.

Run-ups – During maintenance, aircraft engines are sometimes operated (i.e., "run") to check their performance. These engine operations, simply called run-ups, are typically cyclic, i.e., power/throttle is increased and decreased, and can last several minutes. Maintenance run-ups are often performed at nighttime. **Table D-3.6** lists the annual run-up operations modeled for the Year 2010 condition. **Table D-3.6** is identical to the table for existing conditions (**Appendix D-2, Table D-2.11**) except that the run-up operations have been factored (up or down) to reflect the change in flight operations of the aircraft performing run-ups. Maintenance run-ups would be performed at the hold-short areas of Runways 19 and 30 at runway heading. The high-power run-ups last no more than 10 minutes but are primarily during the nighttime period. Approximately four (4) high-power run-ups, on average, would be conducted every night (10pm – 7am).

References

FAA, 2002, Final Environmental Impact Statement, Potomac Consolidated TRACON Airspace Redesign, US Department of Transportation, Federal Aviation Administration, December 2002.

HNTB, 2002, Capacity Review and Alternatives for the Fourth and Fifth Runways at Washington Dulles International Airport, Final Report, February 2002.

HNTB, 2003, Washington Dulles International Airport Updated Activity Forecasts and Simulation, HNTB Corporation, November 2003.

MWAA, 2002. Draft Environmental Assessment, Tier 2 and Related Projects and FAA Draft General Conformity Determination, Washington Dulles International Airport, Metropolitan Washington Airports Authority (MWAA), May 2002. (prepared by EA Engineering, Science, and Technology, Inc.)

TABLE D-3.1

SUMMARY OF ANNUAL AIRCRAFT FLIGHT OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft Family	Aircraft Category	Arrival			Departure			Total		Grand Total
		Day	Night	Total	Day	Night	Total	Day	Night	
Air Passenger	Wide-body Jet	21,412	2,118	23,530	22,117	1,412	23,529	43,529	3,530	47,059
	Narrow-body Jet	71,190	7,040	78,230	73,536	4,695	78,231	144,726	11,735	156,461
	Regional Jet	101,271	10,016	111,287	104,610	6,677	111,287	205,881	16,693	222,574
	Commercial Turboprop	20,496	2,027	22,523	21,171	1,351	22,522	41,667	3,378	45,045
Air Cargo	Wide-body Jet	667	2,508	3,175	667	2,508	3,175	1,334	5,016	6,350
	Narrow-body Jet	368	1,382	1,750	368	1,382	1,750	736	2,764	3,500
	Regional Jet	0	0	0	0	0	0	0	0	0
	Commercial Turboprop	55	205	260	55	205	260	110	410	520
General Aviation / Air Taxi	Business Jet	26,704	4,346	31,050	26,704	4,346	31,050	53,408	8,692	62,100
	Twin-Engine Turboprop	3,524	575	4,099	3,524	575	4,099	7,048	1,150	8,198
	Twin-Engine (Non-Turbo) Prop	2,795	455	3,250	2,795	455	3,250	5,590	910	6,500
	Single-Engine Prop	818	133	951	818	133	951	1,636	266	1,902
Military	Jet	2,550	-	2,550	2,552	-	2,552	5,102	-	5,102
	Turboprop	1,550	-	1,550	1,550	-	1,550	3,100	-	3,100
Total Number		**253,400**	**30,805**	**284,205**	**260,467**	**23,739**	**284,206**	**513,867**	**54,544**	**568,411**
Day/Night Distribution		**89%**	**11%**	**100%**	**92%**	**8%**	**100%**	**90%**	**10%**	**100%**

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m.

Note: Minor differences between total arrivals and total departures may exist due to rounding.

Source: URS Corporation, 2004.

TABLE D-3.2

AIR PASSENGER ANNUAL FLIGHT OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft Category	Representative INM Aircraft Type	Arrival			Departures by Stage Length (SL)														Departure Total			Grand Total		
					SL 1 (0-500nm)		SL 2 (500-1000nm)		SL 3 (1000-1500nm)		SL 4 (1500-2500nm)		SL 5 (2500-3500nm)		SL 6 (3500-4500nm)		SL 7 (4500nm-)							
		Day	Night	Total	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Total	Day	Night	Total
Wide-body Jet	74720B	167	16	183							34	2	69	4			69	4	172	10	182	339	26	365
	747400	1,681	166	1,847							347	22	694	44			694	44	1,735	110	1,845	3,416	276	3,692
	767300	4,667	462	5,129			964	62	643	41	2,250	144	321	21	321	21	321	21	4,820	310	5,130	9,487	772	10,259
	767400																							
	767CF6	730	72	802							754	48							754	48	802	1,484	120	1,604
	767JT9	592	59	651							612	39							612	39	651	1,204	98	1,302
	777200	9,479	938	10,417			316	20	948	60	1,579	101	4,422	282	2,211	141	316	20	9,792	624	10,416	19,271	1,562	20,833
	777300	311	31	342													321	21	321	21	342	632	52	684
	A30062																							
	A310	237	23	260									196	12	49	3			245	15	260	482	38	520
	A330	1,587	157	1,744									1,312	84	328	21			1,640	105	1,745	3,227	262	3,489
	A33034																							
	A340	1,961	194	2,155							338	22	338	22	1,350	86			2,026	130	2,156	3,987	324	4,311
	DC1010																							
	DC1030																							
	MD11GE																							
Narrow-body Jet	717200	3,591	355	3,946	3,401	217	309	20											3,710	237	3,947	7,301	592	7,893
	737300	598	59	657	618	39													618	39	657	1,216	98	1,314
	737400																							
	737500																							
	737700	1,726	171	1,897					594	38	1,189	76							1,783	114	1,897	3,509	285	3,794
	727EM1																							
	727EM2	328	32	360					169	11	169	11							338	22	360	666	54	720
	737800	8,061	797	8,858	2,159	138	2,776	177	1,850	118	1,542	98							8,327	531	8,858	16,388	1,328	17,716
	737N17																							
	757PW	17,929	1,773	19,702	4,395	281	5,336	341	2,511	160	6,278	401							18,520	1,183	19,703	36,449	2,956	39,405
	757RR																							
	A319	14,485	1,433	15,918	5,320	340	1,995	127	3,325	212	4,322	276							14,962	955	15,917	29,447	2,388	31,835
	A320	312	31	343	87	6	112	7	36	2	87	6							322	21	343	634	52	686
	A32023	17,575	1,738	19,313	4,899	313	6,340	405	2,017	129	4,899	313							18,155	1,160	19,315	35,730	2,898	38,628
	A32123																							
	DC870																							
	DC93LW	3,891	385	4,276	1,855	118	2,164	138											4,019	256	4,275	7,910	641	8,551
	F10065																							
	MD83	2,694	266	2,960			1,855	118	927	59									2,782	177	2,959	5,476	443	5,919
	MD9025																							
Regional Jet	CL600	1,171	116	1,287	1,210	77													1,210	77	1,287	2,381	193	2,574
	CL601	95,415	9,437	104,852	81,881	5,226	16,680	1,065											98,561	6,291	104,852	193,976	15,728	209,704
	EMB14L	4,685	463	5,148	4,839	309													4,839	309	5,148	9,524	772	10,296
Commercial Turboprop	DHC6	586	58	644	605	39													605	39	644	1,191	97	1,288
	DHC8	4,099	405	4,504	4,234	270													4,234	270	4,504	8,333	675	9,008
	DHC830																							
	GASEPF																							
	SD330																							
	SF340	15,811	1,564	17,375	16,332	1,042													16,332	1,042	17,374	32,143	2,606	34,749
TOTAL		**214,369**	**21,201**	**235,570**	**131,835**	**8,415**	**38,847**	**2,480**	**13,020**	**830**	**24,400**	**1,559**	**7,352**	**469**	**4,259**	**272**	**1,721**	**110**	**221,434**	**14,135**	**235,569**	**435,803**	**35,336**	**471,139**

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m. SL = Stage Length

Source: Washington Dulles International Airport, Updated Activity Forecasts and Simulation, HNTB Corporation, November 2003.
URS Corporation, 2004.

TABLE D-3.3

CARGO ANNUAL FLIGHT OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft Category	Representative INM Aircraft Type	Arrival			Departures by Stage Length (SL)														Departure Total			Grand Total		
					SL 1 (0-500nm)		SL 2 (500-1000nm)		SL 3 (1000-1500nm)		SL 4 (1500-2500nm)		SL 5 (2500-3500nm)		SL 6 (3500-4500nm)		SL 7 (4500nm-)							
		Day	Night	Total	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Total	Day	Night	Total
Wide-body Jet	74720B																							
	747400																							
	767300	68	257	325			68	257											68	257	325	136	514	650
	767400																							
	767CF6	69	261	330	69	261													69	261	330	138	522	660
	767JT9																							
	777200																							
	777300																							
	A30062	164	616	780	82	308	82	308											164	616	780	328	1,232	1,560
	A310	164	616	780	109	411	55	205											164	616	780	328	1,232	1,560
	A330																							
	A33034																							
	A340																							
	DC1010																							
	DC1030	49	183	232			49	183											49	183	232	98	366	464
	MD11GE	153	575	728			51	192					102	383					153	575	728	306	1,150	1,456
Narrow-body Jet	717200																							
	737300																							
	737400																							
	737500																							
	737700																							
	727EM1																							
	727EM2	185	695	880	185	695													185	695	880	370	1,390	1,760
	737800																							
	737N17																							
	757PW																							
	757RR	128	482	610	128	482													128	482	610	256	964	1,220
	A319																							
	A320																							
	A32023																							
	A32123																							
	DC870	55	205	260	55	205													55	205	260	110	410	520
	DC93LW																							
	F10065																							
	MD83																							
	MD9025																							
Regional Jet	CL600																							
	CL601																							
	EMB14L																							
Commercial Turboprop	DHC6																							
	DHC8																							
	DHC830																							
	GASEPF	55	205	260	55	205													55	205	260	110	410	520
	SD330																							
	SF340																							
TOTAL		**1,090**	**4,095**	**5,185**	**683**	**2,567**	**305**	**1,145**					**102**	**383**					**1,090**	**4,095**	**5,185**	**2,180**	**8,190**	**10,370**

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m. SL = Stage Length

Source: Washington Dulles International Airport, Updated Activity Forecasts and Simulation, HNTB Corporation, November 2003. URS Corporation, 2004.

TABLE D-3.4

GENERAL AVIATION/AIR TAXI ANNUAL FLIGHT OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft Category	Representative INM Aircraft Type	Arrival			Departure			Grand Total		
					SL 1 (0-500nm) only					
		Day	Night	Total	Day	Night	Total	Day	Night	Total
Business Jet	CIT3	1,192	194	1,386	1,192	194	1,386	2,384	388	2,772
	CL600	3,209	522	3,731	3,209	522	3,731	6,418	1,044	7,462
	CL601	1,376	224	1,600	1,376	224	1,600	2,752	448	3,200
	CNA500	538	88	626	538	88	626	1,076	176	1,252
	CNA750	1,103	180	1,283	1,103	180	1,283	2,206	360	2,566
	EMB145	1,322	215	1,537	1,322	215	1,537	2,644	430	3,074
	FAL20	14	2	16	14	2	16	28	4	32
	GIIB	1,090	177	1,267	1,090	177	1,267	2,180	354	2,534
	GIV	2,548	415	2,963	2,548	415	2,963	5,096	830	5,926
	GV	777	126	903	777	126	903	1,554	252	1,806
	IA1125	783	127	910	783	127	910	1,566	254	1,820
	LEAR25	3,222	525	3,747	3,222	525	3,747	6,444	1,050	7,494
	LEAR35	5,783	941	6,724	5,783	941	6,724	11,566	1,882	13,448
	MU3001	3,733	608	4,341	3,733	608	4,341	7,466	1,216	8,682
	SABR80	14	2	16	14	2	16	28	4	32
Multi-engine Turboprop	C130HP	9	2	11	9	2	11	18	4	22
	CNA441	1,480	241	1,721	1,480	241	1,721	2,960	482	3,442
	DHC6	2,008	327	2,335	2,008	327	2,335	4,016	654	4,670
	HS748A	9	2	11	9	2	11	18	4	22
	SD330	18	3	21	18	3	21	36	6	42
Twin-Engine(Non-Turbo) Prop	BEC58P	2,795	455	3,250	2,795	455	3,250	5,590	910	6,500
Single-engine Piston	CNA172	40	7	47	40	7	47	80	14	94
	CNA206	200	32	232	200	32	232	400	64	464
	GASEPF	289	47	336	289	47	336	578	94	672
	GASEPV	289	47	336	289	47	336	578	94	672
Total		**33,841**	**5,509**	**39,350**	**33,841**	**5,509**	**39,350**	**67,682**	**11,018**	**78,700**

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m. SL = Stage Length

Source: Washington Dulles International Airport, Updated Activity Forecasts and Simulation, HNTB Corporation, November 2003. URS Corporation, 2004.

TABLE D-3.5

MILITARY ANNUAL FLIGHT OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft Category	Representative INM Aircraft Type	Arrival			Departures by Stage Length (SL)														Departure Total			Grand Total		
					SL 1 (0-500nm)		SL 2 (500-1000nm)		SL 3 (1000-1500nm)		SL 4 (1500-2500nm)		SL 5 (2500-3500nm)		SL 6 (3500-4500nm)		SL 7 (4500nm-)							
		Day	Night	Total	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Total	Day	Night	Total
Jet	L1011	1,275		1,275			74		92		341		424		246		99		1,276		1,276	2,551		2,551
	A310	1,275		1,275			74		92		341		424		246		99		1,276		1,276	2,551		2,551
Turboprop	DHC6	1,550		1,550	1,550														1,550		1,550	3,100		3,100
Total		**4,100**		**4,100**	**1,550**		**148**		**184**		**682**		**848**		**492**		**198**		**4,102**		**4,102**	**8,202**		**8,202**

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m. SL = Stage Length

Sources: Washington Dulles International Airport, Updated Activity Forecasts and Simulation, HNTB Corporation, November 2003.
Tier 2 Environmental Assessment, MWAA, 2002.

NOTES:

1. Fleet mix based on Tier 2 Environmental Assessment, with the exception of using INM aircraft type C130HNP instead of C130E.
2. Day/Night split based on Updated IAD Activity Forecasts and Simulation, Hourly Distribution of Aircraft Arrivals (Table 3, p. 11) and Departures (Table 4, p. 12).
3. Arrival/departure percentage split assumed 50%/50%.
4. Only available stage length with INM (Version 6.1) for aircraft types C130HNP, DHC6 and KC135R is SL1. Stage length utilization for L1011 and A310 based on average stage length utilization of air carrier wide-body jets.

TABLE D-3.6
SUMMARY OF ANNUAL AIRCRAFT RUN-UP OPERATIONS FOR 2010
Washington Dulles International Airport
Environmental Impact Statement

Aircraft	Number of Engines	INM Aircraft ID	Location	Magnetic Heading (degrees)	Power Setting (% RPM)	Duration per Operation (seconds)	Annual Operations	
							Day	Night
Canadair Regional Jet	2 (jet)	CL601	Runway 30 Hold-short area	301°	100%	600	0	760
					50%	1200	0	760
Jetstream 41	2 (turboprop)	SF340		301°	100%	600	0	118
					50%	1200	0	118
Dornier 328	2 (turboprop)	DHC8		301°	100%	600	0	717
					50%	1200	0	717
Westwind / Astra	2 (jet)	IA1125	Runway 19 L/R Hold-short area	191°	100%	200	23	0
					50%	200	23	0
					Idle	200	23	0

Day = 7:00 a.m. to 10:00 p.m. Night = 10:00 p.m. to 7:00 a.m.

Source: Atlantic Coast Airlines and Signature Flight Support Operations Departments, May 2003.

NOTE:
1. DHC8 operations reflect forecasted increase in Commercial Turboprop DHC8 flight operations.
2. IA1125 operations reflect forecasted decrease in GA business jet IA1125 flight operations.
3. CL601 operations reflect forecasted increase in Regional Jet CL601 flight operations.
4. SF340 operations reflect forecasted decrease in Commercial Turboprop SF340 flight operations.