BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE PAMPHLET 10-1403

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Operations

AIR MOBILITY PLANNING FACTORS

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This pamphlet supersedes AFPAM 10-1403 dated 1 March 1998, *Airlift Planning Factors.* It provides broad air mobility planning factors for peacetime and wartime operations. It is designed to help service, joint, and combined planners make gross estimates about mobility requirements in the early stages of the planning process. It covers strategic airlift, air refueling, and aeromedical evacuation (AE). For greater detail, or in-depth mobility analysis call HQ AMC/A3XP at DSN 779-3627 or TACC/XOP at DSN 779-3107. Ensure that all records created by this AFI are maintained and disposed of IAW AFMAN 37-139, "Records Disposition Schedule."

SUMMARY OF REVISIONS

This document is substantially revised and must be completely reviewed.

This revision incorporates numerous updates, including aeromedical evacuation data, aircraft block speeds, ground times, aircraft utilization (UTE) rates, primary mission aircraft inventory (PMAI), and updates HQ AMC and TACC office symbols and contact information.

Section A—Mobility Planning

1. How To Use This Pamphlet

1.1. There are four basic parts to this pamphlet; terms and definitions, formulas, planning factors, and examples. Although each of these parts can be individually used, we recommend you review the entire contents to get a full understanding of the planning process.

1.2. Due to the number of variables involved in every air mobility operation, the planning factors presented are **not** universally applicable. Instead, they provide "order of magnitude" approximations in the context of a generic scenario. The use of detailed computer simulation models is encouraged for extensive calculations.

Section B—Airlift Formulas

2. Number of Cargo Missions Required

$$= \frac{\text{Requirement}}{\text{Average Payload}}$$

3. Number of Passenger (PAX) Missions Required

$$= \frac{\text{Total Pax} - \text{Pax on Cargo Missions}}{\text{Pax Capability per Pax Mission}}$$

NOTE: Pax on Cargo Missions = Number of Pax seats available on each cargo mission x Number of Cargo Missions.

4. Total Missions Required

= Cargo missions + Pax missions

5. Time to Arrival

= active route flying time + active route ground time

$$\text{ARFT} = \frac{\text{dist 1}}{\text{block speed 1}} + \frac{\text{dist 2}}{\text{block speed 2}} + \ldots$$

ARGT = gnd time 1 + gnd time 2 + gnd time 3 +....

6. Cycle Time

= round trip flying time + round trip ground time

$$RTFT = \frac{\text{dist 1}}{\text{block speed 1}} + \frac{\text{dist 2}}{\text{block speed 2}} + \ldots$$

RTGT = gnd time 1 + gnd time 2 + gnd time 3 +....

7. Closure

$$= \frac{\text{(requirement) x (RTFT)}}{\text{(average payload) x (number of aircraft) x (UTE rate)}}$$

NOTE: For major wartime operations we recommend planners use the wartime objective surge UTE rates published in **Table 6.** For non-mobilized contingencies, we recommend the contingency UTE rates published in **Table 6.** The computations involved in determining actual UTE rates are quite involved and not necessary for initial gross planning estimates.

8. Fleet Capability

(short tons delivered to the theater per day).

$$= \frac{\text{(average payload) x (number of aircraft) x (UTE rate)}}{\text{(RTFT)}}$$

NOTE: This formula is preferred for deliberate planning because it accurately relates the variables affecting the deployment of forces.

9. Fleet Capacity

(million ton-miles per day).

$$= \frac{\text{number of aircraft} \times \text{block speed} \times \text{average payload} \times \text{UTE rate} \times \text{productivity factor}}{1{,}000{,}000}$$

NOTE: Although planners do not commonly use this formula, occasionally we need to convert short ton figures into million ton-miles per day (MTM/D). AMC force structure programmers use MTM/D when funding out-year aircraft purchases and many civilian agencies are accustomed to visualizing our fleet capability in terms of MTM/D. Fleet Capacity is generally more optimistic than actual Fleet Capability for a particular contingency.

10. Airfield Throughput Capability (station capability)

$$= \frac{(\text{MOG}) \times (\text{average payload}) \times (\text{operating hours})}{(\text{ground time})} \quad \text{X 85\% queuing efficiency}$$

NOTE: Use the lower of the working, parking, or fuel MOG.

Section C—Air Refueling Formulas

11. Air Refueling Overview

Refer to **Table 10.**, **Table 11.** and **Table 12.** for determining the approximate number of tankers required to meet the air refueling requirements for various size fighter/airlift deployments. These tables were constructed using average/historical data and will provide a gross estimate of the size and duration of an air refueling operation. If actual mission specifics and data are known, such as aircraft model, configuration, air refueling altitude, airspeed, tanker basing, etc, using the formulas below will provide more accurate planning estimates. However, this formula does not consider specific air refueling abort reserves and its impact on destination fuel. As stated in the introduction we recommend using computer simulation models whenever feasible.

12. Offload Required (per receiver)

= (dist / TAS x fuel flow) - total fuel + dest resv

dist = total distance from takeoff to landing

TAS = average airspeed of receiver leg (use AFP 10-1403 **Table 4.** Blockspeeds for mobility aircraft or applicable flight manual airspeeds for combat aircraft.)

fuel flow = fuel burn rate in lbs/hr

total fuel = total fuel on board at takeoff

dest resv = required fuel reserves at destination

13. Offload Available (per tanker)

= total fuel - (dist / TAS x fuel flow) - dest resv

Tankers required = offload required/ offload available

Section D—Aeromedical Evacuation Formulas

14. Aeromedical Evacuation Overview

Use the following formulas and data in **Table 13.** to determine the AE force and capabilities. In the near term, AE will be primarily accomplished using C-9A, C-21, C-130, C-141, KC-135, or C-17 aircraft, but future availability of these aircraft is uncertain. Any opportune airlift may also be used, keeping the best interest of the patient and crew in mind. When the aeromedical segment (Stage II) of the Civil Reserve Air Fleet (CRAF) is activated, the B-767 will be the primary means of intertheater AE, with augmentation by military aircraft such as KC-135 and C-17, as necessary. An AE crew consists of 2 flight nurses and 3 medical technicians.

15. AE Missions (# required per day)

$$= \frac{\text{\# of Evacuees per day}}{\text{Load Planning Factor}}$$

Load Planning Factor = standard number of patients loaded per aircraft for aeromedical evacuation (See **Table 13.**).

16. AE Crew (# required for missions flown, does not include stage)

= (Msns / day) x (1.25 Crew Planning Factor) x (Crews Per Aircraft) x (Crew Cycle Time)

Use the following standard AE planning factors:

Crews per Aircraft: (Refer to **Table 13.**)

Basic crew duty day = 1

Augmented crew duty day = 1.4

2 for B-767 (4 flight nurses, 6 technicians)

Crew Cycle Time:

Intratheater = 2 days

Intertheater = 4 days (dedicated) 5 days (retrograde)

Dedicated = AE mission from CONUS to CONUS

Retrograde = AE mission from theater to CONUS

NOTE: Flight hours per crewmember must not exceed published 30/90-day limit.

Section E—Examples

17. Airlift Example. As an example of how to use the formulas and planning factors in this pamphlet, assume the following scenario. The 10th Mountain Div. out of Ft. Drum, NY, is to deploy to Kathmandu, Nepal, at the foot of the Himalayas, to assist in earthquake relief. The requirement is to move 700 personnel and 800 short tons of cargo.

17.1. **Suitable Airfield**

17.1.1. Referring to the Aircraft Airfield Restrictions (**Table 1.**), we see that the B767 requires a minimum of 6,000 feet of runway and the C-17 requires a minimum of 3,500 feet. Since the airfield at Ft. Drum, Wheeler-Sack AAF, has a runway length of 10,000 feet, it meets the requirements for both aircraft.

NOTE: Refer to the HQ AMC Airfield Suitability and Restrictions Report (ASRR) to determine suitability. If the airfield does not appear in the ASRR, contact AMC/A3VS and request the airfield be evaluated for use by airlift aircraft. AMC/A3VS will provide prompt feedback and include suitability information in future editions of the ASRR.

17.1.2. Looking in the Kathmandu area, we find Tribhuvan International airport in Kathmandu to have 10,121 feet of run-way which, along with the associated taxiways and ramp, is stressed for B-767 aircraft. Therefore, we make our initial plans based on using Wheeler Sack AAF as the onload and Tribhuvan International as the offload.

17.2. **Missions Required**

Our examples will address only the cargo requirements, however passenger movement would be handled in a similar manner. For all examples to follow, we will assume we have 15 C-17s apportioned for our use and we will use crew staging where necessary.

$$= \frac{\text{Cargo requirement}}{\text{Avg payload}}$$

$$= \frac{\text{800 stons}}{\text{45 stons per C-17}}$$

= 18 C-17 equivalent missions

17.3. **Time to Arrival.** The time required for cargo/pax to arrive at the offload location including all enroute ground times. For this example, the C-17's will depart McGuire (KWRI), fly to Wheeler Sack AAF (KGTB) for onload, then enroute stop at Rota (LERT), Dhahran (OEDR), Delhi, (VIDP), and then offload at Tribhuvan (VNKT). Refer to definitions and tables as needed.

Time to Arrival

= (active route flying time) + (active route ground time)

$$ARFT = \frac{\text{dist 1}}{\text{block speed 1}} + \frac{\text{dist 2}}{\text{block speed 2}} + \ldots$$

$$= \frac{3119}{406} + \frac{2924}{406} + \frac{1443}{398} + \frac{441}{335}$$

= 19.8 hours

NOTE: Block speeds were interpolated from **Table 4.**

ARGT = gnd time 1 + gnd time 2 + gnd time 3 +... (refer to **Table 5.**)

= 6.75 hours

Time to Arrival = 19.8 + 6.75

= 26.55 hours

17.4. **Cycle Time.** For this example, we calculated round trip flying time (RTFT) and round trip ground time (RTGT) using reverse routing except the last leg will be from Rota (LERT) to McGuire (KWRI). Refer to definitions for RTFT and RTGT.

Cycle Time = round trip flying time + round trip ground time

$$RTFT = \frac{\text{dist 1}}{\text{block speed 1}} + \frac{\text{dist 2}}{\text{block speed 2}} + \ldots$$

$$= \frac{248}{335} + \frac{3119}{406} + \frac{2924}{406} + \frac{1443}{398} + \frac{441}{335}$$

$$\frac{441}{335} + \frac{1443}{398} + \frac{2924}{406} + \frac{3140}{406}$$

= 40.5 hours

RTGT = gnd time 1 + gnd time 2 + gnd time 3 +....

= 20 hours

Cycle Time = 60.5 hours

17.5. **Closure**

$$= \frac{\text{(requirement) x (RTFT)}}{\text{(average payload) x (number of aircraft) x (UTE rate)}}$$

$$= \frac{\text{(800 stons) x (40.5 hours)}}{\text{(45 stons) x (15) x (12.5)}}$$

= 4 days

17.6. **Fleet Capability** (short tons delivered to the theater)

$$= \frac{\text{(average payload) x (number of aircraft)t x (UTE rate)}}{\text{(RTFT)}}$$

$$= \frac{(45) \text{ x } (15) \text{ x } (12.5)}{40.5}$$

= 208 stons/day

17.7. **Airfield Throughput Capability.** It is necessary to look at the throughput capability of all airfields associated with a deployment, to determine whether any one airfield limits a planned operation. However, for initial planning, the enroute locations may be assumed to have a higher throughput capability than the onload and offload locations. For this example, we have used Tribhuvan International and a working MOG of one narrow body (NB) aircraft.

Airfield Throughput capability (e.g.., Tribhuvan)

$$= \frac{\text{(MOG) x (average payload) x (operating hours)}}{\text{(ground time)}}$$

$$= \frac{\text{(1) x (45 stons) x (24)}}{(3.25)} \text{ x (85\% queuing efficiency)}$$

= 282 stons/day (Refer to **Table 8.**)

NOTE: Since the arrival airfield can handle the estimated throughput that will be delivered, this calculation is complete. If the throughput had exceeded the airfield's ability to receive it, either the flow would need to be slowed (and throughput decreased) to compensate or the airfield's resources increased to handle the airflow.

18. Air Refueling Example. For this example, assume you need to deploy 6 F-15C's from Langley (KLFI) to Spangdahlem (ETAD). How much fuel and how many tankers (KC-135R) are required? Note: For this example average/historical figures were used. Actual numbers would vary according to aircraft model, configuration, altitude, airspeed, etc.

18.1. **Onload Required (per receiver)**

= (dist / TAS x fuel flow) - total fuel + dest resv

dist = total distance from takeoff to landing

TAS = average airspeed of receiver leg (use **Table 4.** Blockspeeds for mobility aircraft or applicable flight manual airspeeds for combat aircraft.)

fuel flow = fuel burn rate in lbs/hr

total fuel = total fuel on board at takeoff

dest resv = required fuel reserves at destination

= (3500/480 x 10,822) - 23,000 + 7500

= 63,410 lbs (per receiver) x 6 = 380,462 lbs

18.2. **Offload Available (per tanker)**

= total fuel - (dist / TAS x fuel flow) - dest resv

= 180,000 - (3500/480 x 10,718) - 30,000

= 71,848 lbs per tanker

18.3. **Tankers required**

$$= \frac{\text{offload required}}{\text{offload available}}$$

$$= \frac{380{,}462}{71{,}848}$$

= 5 KC-135R's required

19. Aeromedical Evacuation Example. For this example, C-130's will be used to evacuate 500 patients per day.

19.1. **AE Missions (# required)**

$$= \frac{\text{\# of Evacuees per day (500)}}{\text{Load Planning Factor (50)}}$$

= 10 AE Missions required

Table 1. Aircraft Airfield Restrictions.

Aircraft Type	Min Runway[1]		Min Taxiway Width (ft)	Aircraft Classification Number[2,3]				Aircraft Classification Number[2,3]			
	For Landing			Rigid Pavement Subgrades				Flexible Pavement Subgrades			
				High	Med	Low	Ultra Low	High	Med	Low	Ultra Low
	Length (ft)	Width (ft)									
C-9	5000	90	40	11-30	12-32	13-33	14-34	10-28	12-31	14-34	17-39
C-130	3000	60[4]	30	8-34	9-37	11-41	12-43	6-30	8-34	11-37	14-43
C-141	6000	98	50	16-48	18-58	21-68	25-75	17-51	18-58	21-70	28-86
C-17	3500	90	50	22-52	22-52	22-52	24-70	18-52	20-59	22-71	28-94
C-5	6000	147	75	8-29	10-32	11-39	14-48	10-37	13-43	17-54	24-80
KC-10	7000	148	75	12-48	13-57	15-68	18-79	14-58	17-64	21-75	27-102
KC-135	7000	147	75	7-37	8-45	9-54	11-61	7-37	8-45	11-54	15-61
B-747	6600	90	75	16-46	17-55	20-66	24-76	18-52	19-58	21-71	27-92
B-757	4750	90	75	13-30	15-36	17-42	20-48	14-31	15-35	17-43	22-55
B-767	6000	150	75	16-39	17-46	20-56	24-64	18-44	19-48	22-58	28-78
DC-8	6100	90	50	14-50	15-60	19-69	21-78	15-52	16-59	18-71	24-87
DC-10	6100	90	75	20-49	21-59	25-71	29-83	23-59	23-64	26-78	33-106
L-1011	7300	90	75	23-51	25-57	30-70	37-82	24-56	26-63	28-77	36-104
MD-11	7000	150	75	23-58	27-68	34-81	41-94	27-66	30-72	35-88	52-117

NOTES:

1. HQ AMC/A3 retains runway criteria waiver authority for AMC aircraft.
2. Refer to DOD Flight Information Handbook for an airfield's specific PCN and subgrade as well as additional aircraft ACN's. Table reflects values for the heaviest models.
3. Refer to the weight bearing information in the ASRR or GDSS for an airfield's specific PCN and subgrade. Planners will use only the weight bearing information figures published in the ASRR and GDSS.
4. For Non-Tactical Assault Operations, minimum runway width is 80 ft; minimum runway length is 5000 ft.

Table 2. Aircraft Size.

Aircraft Type	Length (ft)	Width (ft)[1]	Maximum Weight (lbs)	Landing[2] Gear Type	Distance For 180 deg. Turn	Required C141 Parking Spots
C-9	119.3	93.4	110,000	T	73	0.4
C-130	99.5	132.6	175,000	ST	74	0.5
C-141	168.4	160	343,000	TT	137	1.0
C-17	173.92	169.75	585,000	TRT	114[3]	1.1[3]
C-5	247.8	222.7	840,000	TDT	150	2.0
KC-10	181.6	165.3	593,000	SBTT	142	1.1
KC-135	136.25	130.85	322,500	TT	130	0.7
B-747	231.83	195.67	836,000	DDT	142	1.7
B-757	155.25	124.83	250,000	TT	92	0.7
B-767	180.25	156.08	352,000	TT	146	1.0
DC-8	187.42	148.42	358,000	TT	132	1.0
DC-10	182.25	165.33	593,000	SBTT	149.42	1.1
L-1011	177.67	164.33	498,000	TT	141.25	1.1
MD-11	201.34	169.5	626,000	SBTT	155.8	1.3

NOTES:

1. Wingtip clearance: 10 ft on each side with wing walker, 25 ft each side without wing walker. (Do not apply to CRAF)
2. Refer to DOD Flight Information Publication (Enroute) for an airfield's maximum runway load bearing capability expressed as a maximum aircraft weight for a particular landing gear type.
3. The C-17 minimum width for a Star Turn is 90 ft. The C-17 can park in a C-141 spot with a wing walker.

Table 3. Aircraft Payloads[1].

Aircraft Type	Pallet Positions	Cargo (s/t)		Passengers[4,6]		Standard NEO Passengers
		ACL[2]	Planning[3]	ACL	Planning	
C-9	-	-	-	40	32	40
C-130	6	17	12	90	80	92/74[5]
C-141	13	30	19	153	120	200/153[5]
C-17	18	65	45	101	90	101
C-5	36	89	61.3	73	51	73
KC-10 (Airlift)	23	60	32.6	75	68	75
KC-135 (Airlift)	6	18	13	53	46	53
A-330	-	-	-	240	240	266
A-300-600	15	79	69	-	-	-
B-747	34	113	98	315	315	380
B-757	15	38	33	125	125	220
B-767	24	67	58	190	190	235
B-777	-	-	-	246	246	320
DC-8	16	40	35	-	-	-
DC-10-10	30	40	35	175	175	350
DC-10-30	30	79	69	242	242	350
L-1011	26	48	42	180	180	335
MD-11	34	98	85	267	267	300

NOTES:

1. Cargo and passenger payloads (except for the C-5) are exclusive of one another.
2. Organic (except C-130) calculated as the maximum ACL for a 3200 nm leg, CRAF calculated for a 3500nm leg. C-130 calculated based on a 2000 nm leg.
3. CRAF based on mixed service averages (B-747-100 Eq = 78 s/tons).
4. CRAF MAX and AVG passengers are the same because pax are loaded to the max allowable by weight.
5. Lower NEO number reflects life raft capacity.
6. Weights are based on 400 lbs per passenger, which includes passenger, baggage, and combat gear. Take total passenger weight into account as part of total cargo weight when requirements dictate movement of cargo and passengers on the same aircraft.

Table 4. Aircraft Block Speeds.

Type	Mach	500 nm	1000 nm	1500 nm	2000 nm	2500 nm	3000 nm	3500 nm	4000 nm	4500 nm	5000 nm	5500 nm	6000 nm
C-9	0.78	344	397	414	420	421	-	-	-	-	-	-	-
C-130	0.49	242	266	272	273	272	271	-	-	-	-	-	-
C-141	0.74	332	380	396	401	401	401	404	407	409	410	-	-
C-17	0.76	335	384	400	405	406	406	409	412	-	-	-	-
C-5	0.77	341	393	410	415	416	416	420	422	424	426	428	429
KC-10	0.81	354	410	428	435	436	437	440	443	446	447	449	450
KC-135	0.79	348	401	419	425	426	426	430	433	435	437	438	439
B-707	0.80	351	405	424	430	431	432	435	438	-	-	-	-
B-747	0.84	363	422	442	450	451	452	456	459	461	463	465	466
B-767	0.81	354	410	428	435	436	437	440	443	446	447	-	-
DC-8	0.80	351	405	424	430	431	432	435	438	440	442	-	-
DC-10	0.83	360	418	438	445	446	447	451	454	456	458	-	-
L-1011	0.81	354	410	428	435	436	437	440	443	446	447	-	-
MD-11	0.83	360	418	438	445	446	447	451	454	456	458	460	461
Assumes standard day, pressure, temperature, -2 degree temperature lapse per 1000 feet of altitude													
Assumes 500nm leg flown at FL180 with linear increase in altitude to FL450 for 4000nm and beyond													
Assumes 20 minute airborne delay for departure, approach, and landing													
Assumes 5 minute taxi time from landing to block-in													
Total time measured from rotation on takeoff leg to block-in after landing													
Total distance measured from point of takeoff to point of landing													
Changes in planned cruise airspeed will alter results													

NOTE: Organic aircraft block speeds obtained from computer flight plan data. Civil aircraft figures are a composite average of various configurations and series participating in CRAF. For Civil aircraft whose passenger and cargo configuration speeds differed, the lower speed was used. All airspeeds are TAS.

Table 5. Ground Times.

Aircraft Type	Passenger and Cargo Operations Wartime Planning Times (hrs+min)				Minimum Crew Rest Times	Aeromedical Evacuation (hrs+min)		
	Onload	En route Refuel only	Offload	Expedited[2]		Reconfigure	Onload/ Offload	Expedited[2]
C-9	-	-	-	-	15+45	1+30	1+30	45
C-130	2+15	1+30	2+15	0+45	16+15	1+30	1+30	45
C-141	3+15	2+15	3+15	1+15	16+00	4+00	2+15	1+15
C-17	3+15	2+15	3+15	1+45	16+30	4+15	2+15	1+45
C-5	4+15	3+15	4+15	2+00	17+00	-	-	-
KC-10	4+15	3+15	4+15	3+15	17+00	-	-	-
KC-135[3]	4+15	3+15	4+15	3+15	17+00	1+30	1+30	45
B-747	3+30/5+00[1]	1+30	3+30/5+00[1]	-	-	-	-	-
B-707	3+00	1+30	3+00	-	-	-	-	-
B-767	3+00	1+30	3+00	-	-	n/a	5+00	5+00
DC-8	2+30/ 3+30[1]	1+30	2+30/ 3+30[1]	-	-	-	-	-
DC-10	2+30/5+00[1]	1+30	2+30/5+00[1]	-	-	-	-	-
L-1011	2+30/5+00[1]	1+30	2+30/5+00[1]	-	-	-	-	-
MD-11	3+30/ 5+00[1]	1+30	3+30/ 5+00[1]	-	-	-	-	-

NOTES:

1. Passenger/Cargo.
2. Onload or offload operations only. Does not include refuel or reconfiguration operations.
3. KC-135 times apply to roller-equipped aircraft.

Table 6. Aircraft Utilization.

Aircraft Type	UTE Rates[1]		Primary Mission Aircraft Inventory (PMAI)[2]				
	Surge	Contingency/Sustained	2003	2004	2005	2006	2007
C-130[1]	6.0	6.0	410	395	388	364	354
C-141	6.5	6.0	66	42	22	8	0
C-17	14.5	12.5	79	94	109	122	136
C-5A/B[5]	8.5 / 11.5	7.7/ 8.1	104	96	94	94	94
KC-10[3]	9.8	8.6	54	54	54	54	54
KC-135[3,5]	6.8	5.1	472	445	429	421	421
CRAF[4]			STAGE 1		STAGE 2	STAGE 3	
A-300	10	10	0/0		0/10	0/10	
B-747	10	10	11/6		27/20	85/61	
B-757	10	10	0/5		0/15	0/69	
B-767	10	10	0/7		0/36	0/138	
B-777	10	10	0/5		0/24	0/84	
DC-8	10	10	6/0		13/0	31/0	
DC-10	10	10	4/6		16/9	86/29	
L-1011	10	10	1/12		1/12	2/12	
MD-11	10	10	9/4		19/6	48/21	

NOTES:

1. Surge UTE rates apply for the first 45 days, (C-130's surge for 30 days).
2. Reflects active/ARC aircraft inventory, not apportionment. See JSCP, Enclosure 11.
3. KC-10 and KC-135 UTE rates apply in the airlift role.
4. CRAF CARGO/PASSENGER aircraft contracted for FY 2003.
5. C-5B UTE Rates reflect AMP/RERP aircraft. KC-135 and C-5 A/B PMAI numbers are based on FY04 POM actions.

Table 7. Productivity Factors.

Tactical (Intra-theater)						
Onload to Offload Distance	500nm	1000nm	1500nm	2000nm	2500nm	3000nm
Productivity Factor	.33	.40	.43	.44	.45	.46
Strategic (Inter-theater)						
Onload to Offload Distance	3000nm	4000nm	5000nm	6000nm	7000nm	8000nm
Productivity Factor	.43	.44	.45	.46	.47	.47
NOTE: Productivity Factors published above reflect average values for broad planning applications. The values above assume average non-productive positioning legs (home station to onload, and offload to recovery) of 250nm for tactical missions and 500nm for strategic missions.						
A more accurate scenario specific productivity factor can be approximated with the equation: Productivity = (onload to offload dist) / (round trip cycle dist).						

Table 8. Maximum Airfield Throughput.

	24 Hour Operations		16 Hour Operations[5]		10 Hour Operations[6]	
MOG[1]	Passengers[2,4]	Cargo[3,4] (s/tons)	Passengers	Cargo (s/tons)	Passengers	Cargo (s/tons)
1	1578	282	1052	188	657	118
2	3155	565	2103	377	1315	235
3	4733	847	3155	565	1972	353
4	6310	1130	4207	753	2629	471
5	7888	1412	5259	942	3287	588
6	9466	1695	6310	1130	3944	706
7	11043	1977	7362	1318	4601	824
8	12621	2260	8414	1506	5259	942
9	14198	2542	9466	1695	5916	1059
10	15776	2825	10517	1883	6573	1177

NOTES:

1. Use the lower of either the working MOG, parking MOG, or fuel MOG.
2. Passenger throughput based on B-767-400 equivalents (average payload 232 passengers, ground time 3+00).
3. Cargo throughput based on C-17 equivalents (average payload 45 s/tons, ground time 3+15).
4. Queing efficiency of 85% applied.
5. Daylight operations in summer months.
6. Daylight operations in winter months.

Table 9. Fuel Burn Rates.

Aircraft Type	Fuel Burn Rate lbs/hr	Aircraft Type	Fuel Burn Rate lbs/hr	Aircraft Type	Fuel Burn Rate lbs/hr
C-9	6,661	B-707	13,916	F-117	9,197
C-130	5,109	B-747	26,800	F-22A	13,154
C-141	13,768	B-767	10,552	F-15C	10,822
C-17	19,643	DC-8	13,916	F-15E	12,669
C-5	23,132	DC-10	20,616	F-18	5,829
KC-10	17,830	L-1011	17,219	F-16	5,854
KC-135R	10,718	MD-11	17,511	A/OA-10	4,160

NOTE: Fuel burn rates extracted from AFPAM 23-221, Fuels Logistics Planning, 1 May 98 and AFI 65-503, US Air Force Cost and Planning Factors, September 02 (converted to lbs/hr using 6.7 lbs/gal conversion rate). Fuel burn rates are for planning purposes only. Actual rate varies according to mission profile, AC model, configuration, altitude, airspeed etc.

Table 10. Tanker Offload Capabilities.

Aircraft	Takeoff Gross Weight (lbs)	Takeoff Fuel Load (lbs)	Max Offload Available (lbs)			
			Mission Radius			
			500nm	1000nm	1500nm	2500nm
KC-135E	300,500	160,000	101,200	78,600	55,800	10,500
KC-135R/T	322,500	180,000	122,200	99,400	76,400	30,700
KC-10	587,000	327,000	233,500	195,200	156,000	78,700

NOTES:

1. This table was extracted from MCM 3-1, Vol II, Tactical Employment KC-135/KC-10, 10 May 95.
2. Based on Sea level, standard day, 10,000-ft dry runway.
3. Offload data based on 1-hour orbit.
4. Cargo carried will reduce fuel load on a 1:1 basis.
5. All KC-10 and a limited number of KC-135 aircraft are refuelable, providing increased range, offload, and loiter capabilities.

Table 11. KC-135 Tanker Aircraft Required.[1,2,3]

Receiver# / Aircraft Type			Distance (nm)			
	1000	2000	3000	4000	5000	6000
2 F-117[4]	1	2	3	3	4	4
3 F-18	0	1	2	3	5	6
6 F-15C	0	2	3	5	6	9
6 F-15E	1	2	5	6	7	8
6 F-22A	1	2	5	6	7	8
6 F-16	0	1	2	3	5	7
6 A/OA-10	0	1	3	4	-	-
3 EA-6B	0	1	2	3	4	4
3 F-14	0	1	2	3	4	5
1 C-141[5]	-	-	-	1	1	2
1 C-17[5]	-	-	-	1	1	2
1 C-5[5]	-	-	-	0	1	2

NOTES:

1. Due to the multitude of Air Refueling variables, this table reflects an "order of magnitude" only.
2. Table assumes multiple tanker launch bases would be used for AR distances greater than 3000nm.
3. Fighter/tanker ratio can be limited by boom cycle time.
4. The F-117 is currently limited to a ratio of only 2 F-117's per tanker.
5. For the airlift aircraft, assume average payloads, maximum takeoff gross weight, optimum located air refueling tracks and divert bases, and a minimum tanker off-load capability of 90,000 lbs.

Table 12. KC-10 Tanker Aircraft Required.[1,2,3]

Receiver # / Aircraft Type	Distance (nm)					
	1000	2000	3000	4000	5000	6000
2 F-117[4]	1	1	2	2	3	3
3 F-18	0	1	2	2	3	4
6 F-15C	0	1	2	3	4	5
6 F-15E	1	1	3	4	5	6
6 F-22A	1	1	3	4	5	6
6 F-16	0	1	1	2	3	4
6 A/OA-10	0	1	1	2	-	-
3 EA6-B[2]	0	1	2	2	3	4
3 F-14[2]	0	1	2	2	3	4
1 C-141[5]	-	-	-	1	1	2
1 C-17[5]	-	-	-	1	1	2
1 C-5[5]	-	-	-	0	1	2

NOTES:

1. Due to the multitude of Air Refueling variables, this table reflects an "order of magnitude" only.
2. Table assumes multiple tanker launch bases would be used for AR distances greater than 3000nm.
3. Fighter/tanker ratio can be limited by boom cycle time.
4. The F-117 is currently limited to a ratio of only 2 F-117's per tanker.
5. For the airlift aircraft, assume average payloads, maximum takeoff gross weight, optimum located air refueling tracks and divert bases, and a minimum tanker off-load capability of 90,000 lbs.

Table 13. Aeromedical Evacuation Capabilities.

Aircraft	AE Crews Per Aircraft[1]	Aeromedical Airlift Capability[2,3]					
		Peacetime	Wartime or Emergency				
		Total Litter/ Ambulatory	All Litter	All Ambulatory	Surge Litter/ Ambulatory	Floor Loading	Load Planning Factors
C-9A	1	9/30	40	40	40	N/A	30
C-130	1	20/38	72	90[4]	50/22	15	50
C-141B (w/ comfort pallet)[5]	1	31/78	N/A[6]	N/A	N/A	N/A	75
C-141B (w/o comfort pallet	1	31/78	103	210[7]	48/38	33	75
C-17[8]	1	9/54	9	102	9/54	60	45
KC-135[8]	1	18/26	18	57	N/A	8	N/A[10]
B-767 (300/ 300ER)	2	87/47[9]	87	47	87/47	N/A	80
B-767 (200/ 200ER)	2	87/28[9]	87	28	87/28	N/A	80

NOTES:

1. Basic crew only.
2. Total positions. Subtract crew members, CCATTs, equipment litters etc as required
3. Various litter and ambulatory patient combinations are available based on requirement.
4. Limited to 80 seats including crew for overwater flights
5. Peacetime strategic missions normally use a comfort pallet
6. Comfort pallets not normally used during contingency ops
7. Limited to 160 seats for overwater flights.
8. No integral litter capability. Patient Support Pallet (PSP) required to increase number of positions. Aircraft can support an additional 9 stanchions (27 litter positions) by re-distributing assets from other airframes.
9. Only configuration possible due to number of ship sets available.
10. Not used for deliberate planning at this time.

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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Air Mobility Strategic Plan 2002

Abbreviations and Acronyms

AC—Aircraft

ACL—Allowable Cabin Load

ACN—Aircraft Classification Number

AE—Aeromedical Evacuation

AMC—Air Mobility Command

AMP/RERP—Avionics Modernization Program/Reliability Enhancement and Reengineering Program

AR EXIT PT—Air Refueling Exit Point

AR—Air Refueling

ARC—Air Reserve Component

ARCP—Air Refueling Control Point

ARCT—Air Refueling Control Time

ARFT—Active Route Flying Time

ARGT—Active Route Ground Time

ARIP—Air Refueling Initiating Point

ASRR—Airfield Suitability and Restrictions Report

AVG—Average

AWACS—Airborne Warning and Control System

C2—Command and Control

CCATT—Critical Care Air Transport Team

CONUS—Continental United States

CRAF—Civil Reserve Air Fleet

CRC—Control and Reporting Center

DEST—Destination

DIST—Distance

DOD—Department of Defense

FT—Feet

GCI—Ground Control Intercept

GDSS—Global Decision Support System

HR—Hour

ICAO—International Civil Aviation Organization

JSCP—Joint Strategic Capabilities Plan

LBS—Pounds

MAX—Maximum

MOG—Maximum (Aircraft) on Ground

MSNS—Missions

MTM/D—Million Ton-Miles per Day

NEO—Noncombatant Evacuation Operation

NM—Nautical Miles

OPLAN—Operational Plan

PAI—Primary Authorized Inventory

PAX—Passengers

PCN—Pavement Classification Number

PMAI—Primary Mission Aircraft Inventory

PSP—Patient Support Pallet

RTFT—Round Trip Flying Time

RTGT—Round Trip Ground Time

RZ—Rendezvous

SAAM—Special Assignment Airlift Mission

S/T or STON—Short Ton

TACAN—Tactical Air Navigation

TACC—Tanker Airlift Control Center

TAS—True Airspeed

UTE—Utilization

VORTAC—Very High Frequency Omnidirectional-range and Tactical Air Navigation

Terms

ACN—See Pavement/Aircraft Classification System.

Active route flying time (ARFT)—The flying time from onload to the offload location including all intermediate locations en route. This does not include ground time.

Active route ground time (ARGT)—The cumulative ground time of all intermediate stops from the onload location to the offload location. This does not include flying time.

Aeromedical evacuation (AE) Patients—(1) Litter = Patient who needs to be carried during both enplaning and deplaning. Patient requires assistance to enplane and deplane. (2) Ambulatory = Patient capable of walking who may not require assistance to enplane and deplane.

Air cargo—Stores, equipment or vehicles, which do not form part of the aircraft, and are part or all of its payload. Note: There are different classifications of military cargo, categorized as follows:

Bulk Air Cargo, including the 463L pallet itself, that is within the usable dimensions of a 463L pallet (104" x 84" x 96") and within the height and width requirements established by the cargo envelope of the particular model of aircraft.

Oversize Cargo exceeding the usable dimensions of a 463L pallet loaded to the design height of 96" but is equal to or less than 1,090" in length, 117" in width, and 105" in height. This cargo is transportable on the C-5, C-17, C-141, C-130, and to a limited extent the KC-10.

Outsize Cargo which exceeds the dimension of oversize (1,090" x 117" x 105") and requires use of a C-5 or C-17.

Rolling Stock Equipment that can be driven or rolled directly into the cargo compartment.

Special Items requiring specialized preparation and handling procedures, such as space satellites or nuclear weapons.

Aircraft block speed—True airspeed in knots under zero wind conditions adjusted in relation to length of sortie to compensate for takeoff, climbout, descent, instrument approach, and landing.

Aircraft parking size—The ramp space a particular aircraft occupies, usually expressed in C-141 equivalents (See **Table 2.**).

Airfield throughput capability—The amount of passengers or cargo which can be moved through the airfield per day via strategic airlift based on the limitations of the airfield (such as parking spots).

Air refueling track —A track designated for air refueling reserved by the receiver unit/planner. If possible, the track from the ARIP to the ARCP should be along a TACAN/VORTAC radial and within 100 NM of the station.

Air refueling initial point (ARIP)—A point located upstream from the ARCP at which the receiver aircraft initiates a rendezvous with the tanker.

Air refueling control point (ARCP)—The planned geographic point over which the receiver(s) arrive in the observation/precontact position with respect to the assigned tanker.

Air refueling control time (ARCT)—The planned time that the receiver and tanker will arrive over the air refueling control point (ARCP).

Air refueling exit point (AR EXIT PT) —The designated geographic point at which the refueling track terminates. In a refueling anchor it is a designated point where the tanker and receiver may depart the anchor area after refueling is completed.

Allowable cabin load (ACL)—The maximum payload that can be carried on a mission. Note: The ACL may be limited by the maximum takeoff gross weight, maximum landing gross weight, or by the maximum zero fuel weight.

Anchor point—A designated geographical point on the down stream end of the inbound course of the Anchor Refueling Pattern.

Anchor refueling—Air refueling performed as the tankers maintain a prescribed pattern which is anchored to a geographical point or fix.

Anchor rendezvous—The procedures normally employed by radar (CRC/GCI/AWACS) to vector the tanker(s) and receiver(s) for a visual join-up for refueling.

Base air refueling altitude—A reference altitude at which lead aircraft of a tanker formation (or single aircraft for individual air refueling) will fly at initial contact.

Civil Reserve Air Fleet (CRAF)—A program in which the DoD uses aircraft owned by a US entity or citizen. These aircraft are allocated by the Department of Transportation (DOT) to augment the military airlift capability of the Department of Defense (DOD). These aircraft are allocated, in accordance with DOD requirements, to segments, according to their capabilities, such as Long-Range International, Short-Range International, Domestic, Alaskan, Aeromedical, and other segments as may be mutually agreed upon by the Department of Defense and the DOT. The CRAF can be incrementally activated by the DOD in three stages in response to defense-oriented situations, up to and including a declared national emergency or war, to satisfy DOD airlift requirements. Note: Recent revisions of the CRAF program have limited the CRAF into just three segments: International, National and Aeromedical Evacuation.

Closure—In transportation, the process of a unit arriving at a specified location. It begins when the first element arrives at a designated location, e.g. port of entry/port of departure, intermediate stops, or final destination, and ends when the last element does likewise, For the purposes of studies and command post exercises, a unit is considered essentially closed after 95 percent of its movement requirements for personnel and equipment are completed.

Critical Care Air Transport Teams (CCATT)—CCATTs provide critical care augmentation to aeromedically evacuate injured, ill and/or burn patients requiring advanced care during transportation. They are available to assist the AE crews if a patient's condition dictates. A CCATT is comprised of three personnel: a physician who maybe an intensivist (cardiopulmonary), a critical care nurse, and a respiratory technician.

Cycle time—Total elapsed time for an aircraft to depart home station, fly a complete mission and be back to start a second time.

Dual role mission—A mission where both air refueling and airlift are provided to the user. The primary mission role is normally air refueling. Missions where cargo movement is primary require a dedicated funded special assignment airlift mission (SAAM).

Enroute rendezvous—A rendezvous procedure whereby the tanker and receiver arrive at a common rendezvous (RZ) point at the same time with 1,000 feet altitude separation.

Fleet capability—The amount of cargo or passengers which can be moved into or out of a location or theater expressed in short tons or pax per day. Limitations include the number of aircraft in the operation, their UTE rate, and the distance between onload and offload locations.

Fuel MOG—See Maximum on Ground.

Global Decision Support System (GDSS)—GDSS is AMC's force level command and control (C2) system supporting Tanker Airlift Control Center (TACC) execution authority for effective airlift mission management. It provides AMC accurate, near real-time data required for making decisions concerning the deployment and employment of AMC resources.

Ground time—The planned ground time for the type of aircraft used.

Maximum on ground (MOG)—Although this term literally refers to the maximum number of aircraft which can be accommodated on the airfield (usually the parking MOG), it is often specialized to refer to the working MOG (maximum number of aircraft which can be simultaneously "worked" by maintenance, aerial port, and others), the fuel MOG (maximum number of aircraft which can be simultaneously refueled) or other constraining factors. It is most commonly expressed in C-141 equivalents.

Missions required—The number of strategic airlift missions (by aircraft type) required to move a requirement from the onload to the offload location.

Noncombatant evacuation operation (NEO)—Operations conducted to relocate threatened noncombatants from locations in a foreign country. These operations normally involve US citizens whose lives are in danger, and may also include selected foreign nationals. Note: NEO planning factors (refer to **Table 3.**) should be used when planning NEO operations. Emergency NEO capabilities represent the most extreme of circumstances.

Number of aircraft—The specific number of aircraft apportioned to any peacetime operation, contingency, or exercise, or the number apportioned in the Joint Strategic Capabilities Plan (JSCP) enclosure 11 for tasked OPLANs.

Parking MOG—See Maximum on Ground.

Pavement/Aircraft classification system—The ICAO standard method of reporting pavement strengths. The Pavement Classification Number (PCN) is established by an engineering assessment of the runway. The PCN is for use in conjunction with an Aircraft Classification Number (ACN). ACN values (provided in **Table 1.**) relate aircraft characteristics to a runway's load bearing capability, expressed as a PCN. An aircraft with an ACN equal or less than the reported PCN can operate on the pavement subject to any limitations on the tire pressure. Refer to DOD Flight Information Publication (Enroute) for an airfield's specific PCN.

Payload—The sum of the weight of passengers and cargo that an aircraft can carry. Note: Cargo weight is normally expressed in short tons.

PCN—See Pavement/Aircraft Classification System.

Planning payload—The payload (expressed in short tons of cargo or number of passengers) expected on a fleet-wide basis, and used by planners to make initial gross planning estimates. The size, shape, and density of most payloads, as well as passenger constraints (i.e., oxygen or life preservers available), rarely permit loading to 100 percent capacity. Planning payload data, not maximum payload data, should be used for operations/transportation planning.

Point parallel rendezvous—A rendezvous accomplished with the tanker maintaining an appropriate offset, the receiver flying the ARIP to ARCP track, and the tanker turning in front of the receiver at a computed range.

Primary mission aircraft inventory (PMAI)—Aircraft authorized to a unit for performance of its operational mission. The Primary authorization forms the basis for the allocation of operating resources to include manpower, support equipment, and flying hours funds.

Productivity factor—Gross measure of an aircraft's expected useful ability to move cargo and passengers to a user, expressed as a percentage. Positioning, depositioning, and other non-productive legs all diminish the overall productivity. For example, on a strategic airlift mission involving an outbound and a return leg, the return leg is normally considered nonproductive. The productivity factor, in this case would be 50 percent. However, this assumes cargo has already been positioned at the aircraft's departure point. In most situations, airlift aircraft must fly one or more positioning legs to an onload location. Since productive cargo is usually not moved at this time, these positioning legs reduce the overall productivity factor to a value less than 50 percent. For planning purposes use the productivity, factors found in **Table 7.**, or calculate your own by dividing productive leg distance (onload to offload) by round trip cycle distance.

Queuing efficiency—A factor used by planners and applied in formulas (i.e.,. throughput capability) to account for the physical impossibility of using limited airfield facilities with perfect efficiency. For example, when a parking spot is vacated, it is never instantly re-occupied. Historically, planners have applied a queuing efficiency of 85 percent.

Requirement—

Airlift. The force to be moved in number of passengers or short tons of cargo.

Tanker. The number and type of receivers, fuel desired, time to loiter, and AR track.

Round trip flying time (RTFT)—The accumulated flying time from the aircraft's starting point, to the onload location, through the en route structure, to the offload location, back through the enroute system, to starting point of origin or other final destination.

Round trip ground time (RTGT)—The accumulated ground time from the aircraft's starting point, to the onload location, through the en route structure, to the offload location, back to the final destination.

Short Ton (S/T or STON)—2,000 pounds.

Time to arrival —The time required for cargo/pax to arrive at the offload location including all enroute ground times.

USE rate—The capability of a subset of PMAI aircraft to generate flying hours expressed in average flying hours per aircraft per day. Computed only for those aircraft applied to a specific mission. For example, consider an operation using 2 C-17 aircraft. If 1 aircraft flies 10 hours while the other is in maintenance, then one aircraft has 10 hours of USE rate and the other has 0 hours of USE rate. Collectively, these two aircraft generate 5.0 hrs/day of "USE".

Utilization rate (UTE rate)—The capability of a fleet of aircraft to generate flying hours in a day, expressed in terms of per Primary Authorized Inventory (PAI). Applies only to long-term, large scale operations such as OPLANs. For small operations involving less than the entire fleet, UTE rates are not normally a factor.

Wartime Objective "Surge" UTE Rate = A command established flying hour goal for planning and programming to meet JCS directed wartime objectives in the first 45 days of the most demanding wartime operations. AMC sets this rate as a target for planning and programming aircrews, maintenance, and aerial port manpower, active and reserve force mixes, and spare parts. This early 45 day surge period assumes the deferral of scheduled maintenance, support people working overtime, and the full mobilization of both active and reserve forces with fully funded and fully stocked spares in supply.

Wartime Objective "Sustained" UTE Rate = Sustained UTE rates represent another Command goal for planning purposes. After a 45 day surge operation in wartime, the immediate demand for airlift decreases somewhat and a greater percentage of needed equipment arrives by ship. AMC plans to fly at a lower operational tempo known as a sustained UTE rate. This reduced rate is based upon normal duty days, 100% active and reserve participation, and the accomplishment of maintenance activities deferred in the surge period.

Contingency Non-Mobilized UTE Rate = Sustained rate of flying hour activity based upon full active duty participation and 25% reserve volunteerism. (e.g. JUST CAUSE, RESTORE HOPE, PROVIDE COMFORT).

Working MOG—See Maximum on Ground.