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Operations

AIR MOBILITY PLANNING FACTORS

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OPR: HQ AMC/DOXP (MAJ Westerbrook)

Certified by: Deputy AF/XOR
(Col David M. Edgington)

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This pamphlet supersedes AFP 76-2 dated 29 May 1987, *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/DOXP at DSN 576-2110 or TACC/XOP at DSN 576-3388.

Section A— Mobility Planning

1. How To Use This Pamphlet. 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.

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. Number of Cargo Missions Re quired.

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

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)

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

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

6. Cycle Time.

= round trip flying time + round trip ground time

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

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

7. Closure .

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

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 USE rates published in table 6. The computations involved in determining actual USE rates is quite involved and not necessary for initial gross planning estimates.

8. Fleet Capability. (short tons delivered to the theater per day).

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

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 this formula is not commonly used by planners, 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 either the working, parking, or fuel MOG.

Section C— Air Refueling Formulas

11. Air Refueling Overview. Refer to tables 10, 11 and 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. The primary strategic AE aircraft are the B-767, and the C-141. The C-130 and C-9A are the primary tactical AE aircraft. An AE crew consists of 2 flight nurses and 3 medical technicians.

15. AE Missions (# required per day).

= # of Evacuees per day

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)

Tactical = 1

Strategic = 1.5 for C-141, C-17 (3 flight nurses, 4 technicians)

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

Crew Cycle Time:

Tactical = 2 days

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

Dedicated = AE mission from CONUS to CONUS

Retrograde = AE mission from theater to CONUS

Note: Flight hours per crew member 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.

Suitable Airfield

Referring to the Aircraft Airfield Requirements table, we see that the B747 requires a minimum of 6,600 feet of runway and the C-141 requires a minimum of 6,000 feet. Since the airfield at Ft. Drum, Wheeler-Sack AAF, does not have the required runway length, we choose a nearby alternative, Griffiss AFB, with a runway length of 11,820.

Note: Refer to the HQ AMC Airfield Suitability Report (ASR) to determine suitability. If the airfield does not appear in the ASR, contact your MAJCOM DOTV and request the airfield be evaluated for use by airlift aircraft. Your MAJCOM DOTV will provide prompt feedback and include suitability information in future editions of the ASR.

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 B747 aircraft. So, we make our initial plans based on using Griffiss AFB as the onload and Tribhuvan International as the offload.

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 40-C141s apportioned for our use.

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

$$= \frac{\text{800 stons}}{\text{19 stons per C-141}}$$

= 42 C-141 equivalent missions

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-141's will depart McGuire (KWRI), fly to Griffiss (KRME) 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)

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

$$= \frac{3119}{400} + \frac{2911}{398} + \frac{1441}{366} + \frac{436}{227}$$

= 21.0 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 = 21.0 + 6.75

= 27.75 hours

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

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

$$= \frac{192}{227} + \frac{3119}{400} + \frac{2911}{398} + \frac{1441}{366} + \frac{436}{227}$$

$$\frac{436}{227} + \frac{1441}{366} + \frac{2911}{398} + \frac{3140}{400}$$

= 42.8 hours

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

= 20.25 hours

Cycle Time = 63.05 hours

Closure

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

= (800 stons) x (42.8 hours)

(19 stons) x (40) x (7.4)

= 6 days

Fleet Capability (short tons delivered to the theater)

= (average payload) x (number of aircraft)t x (USE rate)

(RTFT)

= (19) x (40) x (7.4)

42.8

= 131.4 stons/day

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 (i.e., Tribhuvan)

= (MOG) x (average payload) x (operating hours)

(ground time)

= (1) x (19 stons) x (24) x (85% queuing efficiency)

(2.25)

= 172.3 stons/day (Refer to table 8)

NOTE: Since the arrival airfield can handle more throughput than 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.

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 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 7500) - 23,000 + 7500

= 39,187 lbs (per receiver) x 6 = 235,125 lbs

Offload Available (per tanker)

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

= 175,000 - (3500/480 x 10,000) - 30,000

= 72,083 lbs per tanker

Tankers required

= offload required
offload available

= 235,125
72,083

= 4 KC-135R's required

19. Aeromedical Evacuation Example. For this example, C-141's (with comfort pallet) will be used to evacuate 500 patients per day.

AE Missions (# required)

= # of Evacuees per day (500)
Load Planning Factor (63)

Table 1. Aircraft Airfield Restrictions.

Aircraft Type	Min Runway[1] For Landing		Min Taxi-way Width (ft)	ACN[2,3] (Rigid Pavement) Subgrades				ACN[2,3] (Flexible Pavement Subgrades)			
	Length (ft)	Width (ft)		High	Med	Low	Ultra Low	High	Med	Low	Ultra Low
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	17-49	18-58	21-70	28-85
C-17	3000	90	50	22-52	22-52	22-52	24-70	18-52	20-59	22-71	28-94
C-5A/B	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. Runway criteria for AMC aircraft can be waived on a case-by-case basis, by the HQ AMC/DO.

2. Refer to DOD Flight Inforamtion Handbook for additional aircraft ACN's. Table reflects values for the heaviest models.

3. Refer to DOD Flight Information Publication (Enroute) for an airfield's specific PCN and subgrade.

4. For Non-Tactical Assualt Operations, minimum runway width is 80ft, minimum runway length is 5000ft.

Table 2. Aircraft Size.

Aircraft	Length (ft)	Width (ft)1	Maximum	Landing2	Distance	Required C141
Type			Weight (lbs)	Gear Type	For 180 deg.	Parking Spots
					Turn	
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	1143	1.13
C-5A/B	247.8	222.7	840,000	TDT	150	2.0
KC-10	181.6	165.3	593,000	SBTT	149.5	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	Cargo (s/t)		Passengers[4]		Standard NEO
	Positions					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	102	90	102
C-5A/B	36	89	61.3	73	51	73
KC-10 (Airlift)	25	60	32.6	75	68	75
KC-135 (Airlift)	6	18	13	53	46	53
B-747	44	100	86	335	335	390
B-757	15	38	33	110	110	216
B-767	24	65	56	205	205	215
DC-8	16	38	33	125	125	190
DC-10	30	72	62	210	210	280
L-1011	26	59	51	180	180	350
MD-11	35	93	80	315	315	300

Notes:

1. Cargo and passenger payloads (except for the C-5) are exclusive of one another.

2. Organic calculated as the maximum ACL for a 3200 nm leg, CRAF calculated for a 3500nm leg.

3. Historical averages from Desert Storm/Shield. 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.

Table 4. Aircraft Block Speeds[1]

Type	500nm	1000 nm	1500nm	2000 nm	2500nm	3000 nm	3500 nm	4000 nm	5000 nm
C-9	247	353	390	406	414	-	-	-	-
C-130	185	208	246	262	270	-	-	-	-
C-141	227	332	370	386	394	399	405	414	-
C-17	243	348	386	402	410	415	421	430	-
C-5A/B	242	347	385	401	409	414	420	429	429
KC-10	267	372	410	426	434	439	445	454	454
KC-135	252	357	395	411	419	424	430	439	439
B-747	287	392	430	446	454	459	465	474	474
B-757	267	371	410	426	434	439	445	454	454
B-767	272	376	415	431	439	444	450	459	459
DC-8	262	367	405	421	429	434	440	449	-
DC-10	277	381	420	436	444	449	455	464	464
L-1011	277	382	420	436	444	449	455	464	464
MD-11	277	382	420	436	444	449	455	464	464

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.

Table 5. Ground Times

Aircraft Type	Passenger and Cargo Operations Wartime Planning Times (hrs+min)				AR Regen Times4	Minimum Crew Rest Times	Aeromedical Evacuation (hrs+min)		
	On-load	En-route	Off-load	Expedited2			Reconfigure	On-load / Off-load	Expedited[2]
C-9	-	-	-	-	-	15+45	1+30	1+30	45
C-130	1+30	1+30	1+30	0+45	-	15+15	1+30	1+30	45
C-141	2+15	2+15	2+15	1+15	-	16+00	4+15 3	2+15	1+15
C-17	2+15	2+15	2+15	1+45	-	16+00	4+153	2+15	1+45
C-5A/B	4+15	3+15	3+15	2+00	-	17+00	-	-	-
KC-10	4+15	3+15	3+15	3+15	2+30	17+00	-	-	-
KC-1355	3+30	2+30	3+30	2+30	2+30	17+00	-	-	-
B-747	3+30 / 5+00 1	1+30	2+00 / 3+001	-	-	-	-	-	-
B-757	2+00	1+30	2+00	-	-	-	-	-	-
B-767	2+00	1+30	2+00	-	-	-	n/a	5+00	5+00
DC-8	2+30 / 3+301	1+30	2+00 / 1+15 1	-	-	-	-	-	-
DC-10	2+30 / 5+00 1	1+30	3+00	-	-	-	-	-	-
L-1011	2+30 / 5+00 1	1+30	2+00 / 3+001	-	-	-	-	-	-
MD-11	3+30 / 5+001	1+30	3+00	-	-	-	-	-	-

Notes:

1. Passenger/Cargo.

2. Onload or offload operations only. Does not include refuel or reconfiguration operations.

3. The time required to reconfigure for limited retrograde evacuation of patients only as far as the next location.

4. Sortie regeneration times for Air Refueling missions.

5. KC-135 times apply to roller-equipped aircraft.

Table 6. Aircraft Utilization.

Air-craft Type	UTE Rates[1]		Contin-gency USE Rates	Primary Mission Aircraft Inventory (PMAI)[2]				
	Surge	Sus-tained		1997	1998	1999	2000	2001
C-93	8	8	8.0	18	18	18	18	18
C-1301	6.0	4	6.0	432	388	388	388	388
C-141	12.1	9.7	7.4	161	143	135	103	88
C-17	15.15	13.9	11.7	24	30	37	46	58
C-5A/B	10.0 / 11.4	8.4/ 8.4	5.8/7.5	104	104	104	104	104
KC-10[4]	12.5	10	7.9	54	54	54	54	54
KC-135[4]	-	-	5.6	472	472	472	472	472
CRAF[5]				STAGE 1		STAGE 2	STAGE 3	
B-747	10	10	10	16 / 14		36 / 36	59 / 71	
B-757	10	10	10	0 / 7		0 / 9	0 / 30	
B-767	10	10	10	0 / 4		0 / 12	0 / 57	
DC-8	10	10	10	19 / 0		36 / 0	85 / 0	
DC-10	10	10	10	4 / 5		9 / 31	40 / 76	
L-1011	10	10	10	0 / 8		0 / 17	5 / 24	
MD-11	10	10	10	2 / 5		14 / 14	27 / 19	

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. PMAI reflects Air Evac aircraft only.

4. KC-10 and KC-135 UTE rates apply in the airlift role.

5. CRAF CARGO/PASSENGER aircraft contracted

for FY 1997.

6. CRAF Stage 3 Cargo Planning Factor = 120 B-747-100 Wide Body Equivalents.

Table 7. Productivity Factors[1].

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 scenario specific productivity factor can best 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	1139	172	759	115	475	72
2	2278	345	1519	230	949	144
3	3417	517	2278	345	1424	215
4	4556	689	3037	459	1898	287
5	5695	861	3797	574	2373	359
6	6834	1034	4556	689	2848	431
7	7973	1206	5315	804	3322	502
8	9112	1378	6075	919	3797	574
9	10251	1550	6834	1034	4271	646
10	11390	1723	7593	1148	4746	718

Notes:

1. Use the lower of either the working MOG, parking MOG, or fuel MOG.

2. Passenger throughput based on B-747 equivalents (average payload 335 passengers, ground time 3+00).

3. Cargo throughput based on C-141 equivalents (average payload 19 s/tons, ground time 2+15).

4. Queing efficiency of 85% applied.

5. Daylight operations in summer months.

6. Daylight operations in winter months.

Table 9. Fuel Burn Rates[1].

Aircraft Type	Fuel Burn Rate lbs/hr	Aircraft Type	Fuel Burn Rate lbs/hr	Aircraft Type	Fuel Burn Rate lbs/hr
C-9	6,667	B-707	13,916	F-117	9380
C-130	5,360	B-747	26,800	RF-4	9,715
C-141	13,902	B-767	10,552	F-15C	7,500
C-17	18,0002	DC-8	13,916	F-15E	10,586
C-5	23,450	DC-10	20,616	EF-111	9,715
KC-10	17,755	L-1011	17,219	F-16	5,360
KC-135R	10,921	MD-11	17,511	A/OA-10	4,121

Notes:

1. Fuel burn rates extracted from AFP 144-4, Fuels Logistics Planning, 22 Apr 1 (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.

2. C-17 rates are based on historical data.

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	275,700	160,000	101,200	78,600	55,800	10,500
KC-135R/T	301,700	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**
6 F-117[4]	3	3	5	6	8	11
6 RF-4	1	2	4	6	9	13
6 F-15C	0	2	3	5	6	9
6 F-15E	1	2	5	6	10	14
6 EF-111	0	1	3	5	7	11
6 F-16	0	1	2	3	5	7
6 A/OA-10	0	1	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 offload 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**
6 F-117[4]	3	3	3	6	6	7
6 RF-4	1	1	3	3	6	7
6 F-15C	0	1	2	3	4	5
6 F-15E	1	1	3	4	5	8
6 EF-111	0	1	2	3	4	6
6 F-16	0	1	1	2	3	4
6 A/OA-10	0	1	1	2	-	-
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.

Table 13. Aeromedical Evacuation Capabilities.

Aircraft	AECrews perAir-craft	Aeromedical Airlift Capability					
		Peacetime	Wartime or Emergency				
		TotalLit-ter/Ambu-latory	AllLitter	AllAmbu-latory	SurgeLit-ter/Ambu-latory	Floor-Loading	LoadPlan-ningFactors
C-9A	1	9/30	40	40	401	N/A	39
C-130A,B,E,H	1	24/36	74[3]	36/82	50/221	15	50
C-141B (w/ comfort pallet)	1.5[7]	31/78	48	140[4]/165[5]	48/38	30	63
C-141B (w/o comfort pallet	1.5[7]	31/78[6]	48	161[4]/195[2,5]	48/38	33	63
C-17	1.5[7]	36/54	36	54	36/54	N/A	45
B-767 (300/ 300ER)	2[7]	87/48	87	48	87/48	N/A	120
B-767 (200/ 200ER)	2[7]	87/33	87	33	87/33	N/A	120

Notes:

1. Various litter and ambulatory patient combinations are available at all times.

2. Side facing (Evans) seats are used.

3. If a full medical crew is on board, only 70 positions are available.

4. Aft facing seats are used.

5. Due to life raft limitations, the number of ambulatory patients may be reduced to 160 on overwater flights.

6. Peacetime strategic missions normally use a comfort pallet.

7. 1.5 crews = 3 flight nurses/4 AE technicians. 2 crews = 4 flight nurses/6 AE technicians.

PATRICK K. GAMBLE, Lt Gen, USAF
DCS/Air & Space Operations

Attachment 1

GLOSSARY OF REFERENCES AND TERMS

References

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Terms

ACN—See **Pavement/Aircraft Classification System**.

Active route flying time—(ARFT) The flying time from the 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 requires assistance to enplane and deplane. (2) Ambulatory = Patient does 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 it's payload. **Note:** There are different classifications of military cargo, categorized as follows:

<u>Bulk</u> 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.

<u>Oversize</u> 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, letdown, 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 which 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.

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 where-by 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 USE rate, and the distance between onload and offload locations.

Fuel MOG—See Maximum on Ground.

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-141 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.

<u>Wartime Objective "Surge" UTE Rate</u> = 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.

<u>Wartime Objective "Sustained" UTE Rate</u> = 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.

<u>Contingency Non-Mobilized USE Rate</u> = 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**.