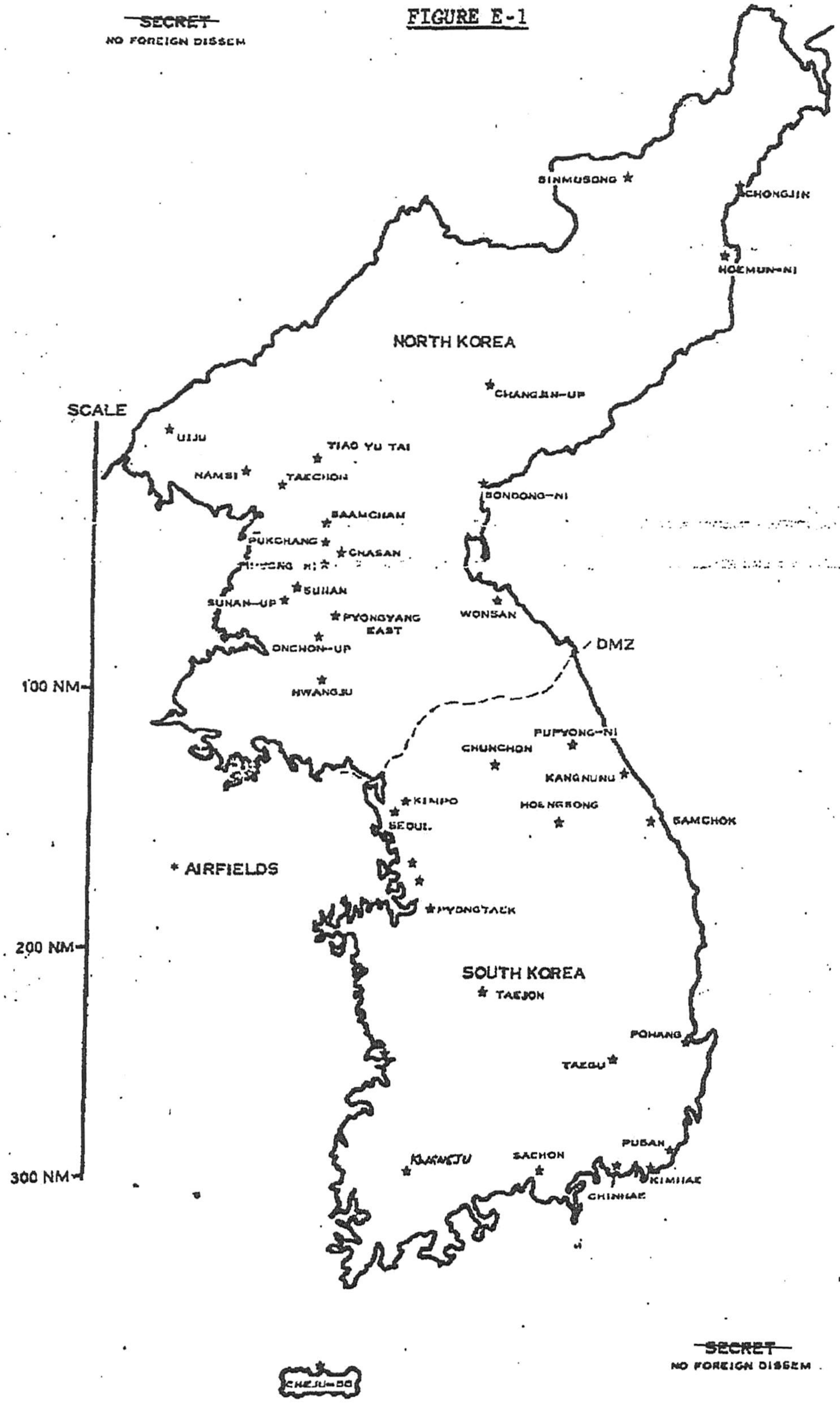
~~SECRET~~
NO FOREIGN DISSEM

FIGURE E-1



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Energy-Maneuverability (E-M) is the rate at which an airplane can gain or lose energy (equivalent to instantaneous available rate of climb) over the entire spectrum of speed, altitude, and g-loading (turn or pull-up). It is a measure of a fighter's ability to gain favorable position over other aircraft. This must be assessed over the entire range of values likely to be encountered in combat, remembering that one fighter airplane can almost never achieve E-M superiority over all other airplanes throughout this spectrum and that pilots will try to force combat into their regions of superiority. The results of actual flight tests* shows that, in spite of kill statistics, the pilot having an aircraft with an ultimate speed and/or altitude advantage over his adversary is at a decided advantage because engagement or disengagement is his prerogative. This in turn generates positive psychological factors in knowing that your adversary has, or does not have, this potential. An analysis of actual combat situations plus flight tests have indicated combat speeds from 150 knots to Mach 1.2. E-M determinations, therefore, must be evaluated for both military power and afterburner conditions, which due to the fuel consumption differences, has a definite impact on the ability to sustain an engagement.

Present estimates of E-M characteristics of U.S. aircraft are generally well verified by empirical analyses and flight tests. Estimates of MIG aircraft E-M are based on AFSC/FTD's quadratic approximation of the lift-drag relationsh p and flight tests in some cases. The specific energy plots at 3g and 5g (high left maneuvering flight - the area of advantage usually ascribed to Soviet aircraft) are generally optimistic. Brief descriptions of E-M characteristics in the region below 30,000 and Mach 1.2 are given below.

MIG-15 and -17 and F-86. These subsonic aircraft are roughly equivalent in E-M to the F-86 except that they have the traditionally lower placard speed limit of Soviet airplanes (F-86 has a supersonic placard limit).** The -17 is an afterburning version of the -15 with some advantage over the -15 using A/B at the sacrifice of military power (MP) performance. All three of these aircraft have substantial E-M advantages at 5gs and below Mach .6 over most higher performance aircraft except for the MIG-19, emphasizing the fact that aircraft cannot achieve E-M dominance over the full speed and altitude spectrum. Th.. MIG-19 has a very substantial subsonic E-M advantage,

* Project HAVE DONUT were one-on-one and multiple aircraft air-to-air tactics evaluation tests. The major proportion of combat flying turned out to be subsonic. This is due mainly to the transonic drag rise characteristics of even the fastest present-day aircraft which causes relatively slow acceleration through the sound barrier.

** See Table E-1 for a general comparison of fighter aircraft capabilities.

particularly at high Gs, where it is even superior at modernate speeds to the highly maneuverable F-86 group. The above conclusions hold both with and without A/B.

F-5A (Improved). The F-5, Mach 1.4 version currently being sold has subsonic E-M equivalent to the MIG-19 except at low speed, high G (i.e., almost matches the subsonic fighters at low speeds with increasing advantage at increasing Mach number) but has transonic and supersonic superiority.

MIG-21, F-104, F-102, F-4, and F-5. Of these high-speed fighters in the A/B condition, the F-104 has the best 1G energy characteristics (by a small margin) but the worst 5G characteristics (by a large margin). The F-4 and the MIG-21 show no substantial differences between Mach .7 and Mach 1.2 below 30,000 feet with a slight 1G advantage for the F-4 and an increasing 5G advantage below Mach .7 for the MIG-21. The F-4s advantage increases in the important military power condition.

Within the performance limits of the aircraft, the F-5 has considerable potential for engaging the MIG-21 in a tactical situation. At altitudes below 15,000 feet, the F-5 has a performance advantage in speed. The tactical engagement can be controlled affectively by the F-5 and if defensive separation is necessary it can exceed the MIG-21's airspeed envelope below 15,000 feet. The F-5 can closely simulate the MIG-21 up to Mach 1.2 for combat crew training in Air Combat Maneuvers, dissimilar aircraft engagement.

Acceleration Comparison. The MIG-21 has a slight advantage in after-burner acceleration, and an equal acceleration capacity in military power. The F-5 is limited to Mach 1.4, therefore, the MIG-21 has a distinct performance advantage at higher Mach numbers. The F-5 demonstrated superior acceleration capabilities in military and afterburner power at low altitude (15,000 feet) up to the placard limit of the MIG-21 of 595 knots.

Zoom Comparison. Starting from 10,000 feet, 0.9 Mach using full after-burner in a 30 degrees pitch zoom, the MIG-21 had slightly better performance.

Turn Comparison. The F-5N and MIG-21 are closely matched in turn capability between .9 and 1.2 IMN. The MIG-21 has more instantaneous G available below .9 IMN; however, the F-5N has a slightly better sustained G capability. Therefore, the two aircraft have comparable turn capability.

General. During air combat maneuvers (ACM), the F-5 and MIG-21 performed the same maneuvers. Because of the small size of both aircraft, visual acquisition was difficult. The restrictions to visibility in the MIG-21 caused loss of visual contact and a resultant "kill" position was obtained by the F-5. The turn, zoom, and acceleration capabilities were closely matched and the results of the ACM were determined by pilot tactical proficiency rather than superior aircraft performance. Radar returns of the MIG-21 and F-5 are nearly equal. The F-5 can exceed the low altitude speed limit of the MIG-21. The F-5 also has better cockpit visibility. The F-5s slow speed maneuverability and fuel specifics are comparable to the MIG-21. The F-102 low wing loading gives it excellent turning ability, but it lacks sufficient thrust to sustain high energy level. At max power it should outperform the MIG-17 in most areas from S. L. to 50,000 feet. The MIG-19 and -21 have far superior thrust to weight ratio and are able to outperform the F-102 in most areas. The F-102 and the F-106 fire control systems and armament, (i.e., missiles only-no guns) limits its effectiveness in a fighter vs fighter situation. The system lacks a close-in kill capability. The turning capability of the F-102 is one characteristic which will afford it some survivability in the Korean theater. It should be recognized that the F-102 was designed to counter the non-maneuvering bomber threat to the CONUS during the mid-50 through the 1960 time period. Periodic improvements to the Fire Control System and Armament, such as the ACM 26A/B, IR Search and Track System, and improved ECCM capability have increased the F-102s potential against the essentially straight track high speed target. A proposed MG-10 Fire Control System modification would further enhance the weapon flexibility and provide a limited anti-fighter capability; however, this would not be sufficient to credit the F-102 with much potential in a clear air mass contact against a maneuverable fighter. Against the fighter/fighter bomber threat of North Korea, the F-102 is at a decided disadvantage because the current MG-10FCS is too complex for effective employment in a CAM fighter vs fighter environment. Additionally, the susceptibility to engine compressor stalls and the absence of a gun further degrade the F-102's probability of success in a CAM duel. Because current missiles can be outmaneuvered, the attack logic developed to counter the bomber threat still dictates the primary method of employing the weapons system which, from a practical aspect, would be found in the classic air defense environment.

Combat Fuel Available and Loiter Time. Soviet type aircraft and US aircraft (to a lesser extent) cannot turn on afterburner at the sight of an enemy and leave it on to the conclusion of an engagement. Afterburner must be applied sparingly and briefly in combat and its use is an integral part of combat tactics. It is used only to improve position, initiate or break off combat, or force a more fuel-limited enemy into using his A/B (note that fuel flow in A/B can be 3-6 times as high as in military power and 10-20 times as high as in loiter). Naturally, an aircraft with latitude in the use of A/B because of more fuel available has a significant advantage in combat; the opponent using afterburner has a substantial advantage in energy-maneuverability. Fuel available depends, of course, on the aircraft, the engagement geography (distances from base of opponents) and the availability of pre- or post-engagement aerial refueling.

Visibility. Apart from search and detection improvements, good visibility is essential for retaining orientation during the extremely complex three-dimensional maneuvering that takes place. Profile is also important in reducing the enemy's visual and electronic detection ability. As opposed to Korean War experience (where hostile aircraft were spotted from the forward observations), the detection of hostile aircraft in SEA has occurred throughout a 270° spectrum.

The aircraft in the fighter group with outstanding visibility is the F-86. The MIG-15, -17, -19, -21, F-5, and F-104 have roughtly equivalent visibility. The F-4/F-102 has poorer visibility. The MIG-21, F-5, and F-104 all have sufficiently small profiles to significantly reduce both visual and radar detection. The F-4 and F-102 not only have large profiles but both have a highly visible smoke trail.

Ordnance. An obviously important factor is high single shot kill ratio of air-to-air ordnance. Other important factors are: ability to launch during high-G maneuver and against maneuvering targets. In the classic "dogfight" situation, when the enemy is on a tail chase, it is absolutely essential that a high G-load be maintained to prevent the attacker from establishing a "lead" with either guns or missiles (only guns have the ability to launch consistently over 2-3G's today; SIDEWINDER, SPARROW, and FALCON missiles all can be out-maneuvered); ability to launch at short range after visual identification (guns only today); ability to launch from a wide angle off the target tail or nose (very limited capability today for maneuvering targets); short pre- and post-launch tracking time (a significant disadvantage of the standard Soviet beam-riding missile).

The NKAF aircraft carry substantially inferior guns with rates of fire of 500-800 rounds/minute and muzzle velocities of 2200 to 2700 feet/minute. The ROK aircraft carry either the M-61 6,000 rounds/minute 20mm cannon or the M-39 1500 rounds/minute 20 mm (two on the F-5), both with 3600 feet/second muzzle velocity.

Pilot Ability. Historical studies of WW I, WW II, and the Korean air combat indicate that pilot ability is probably more important in air-to-air combat than equipment differences. Pilot ability, as measured by the probability of winning a decisive combat (i.e., one where there is a win or loss outcome) is not normally distributed. The best pilots of either side, despite rather substantial equipment differences, will have surprisingly constant probabilities of winning decisive combats. The combat experience being gained in Vietnam by some NKAF pilots will be an invaluable experience asset for many years.

APPENDIX F: ROKAF COMMUNICATIONS

F.1 ROKAF Air Defense Communications

The ROKAF air defense communications system consists of a variety of links: troposcatter, HF radio, single side band, and microwave. In addition, PACAF has provided mobile point-to-point USAF equipment following the Pueblo crisis to strengthen the critical communications links to USAF standards. The other ROK communications facilities include the ROKAF microwave system, the DC microwave system, the ROK Naval communication system, and the more recent counter-infiltration net.

F.11 Troposcatter/Microwave System

The Korean air defense communications system consists of three troposcatter links of twenty-four voice channels and one teletype channel each between: (1) Paegnyongdo and Pyongtaek, (2) Pyongtaek and Juliett, and (3) Kunsan and Cheju-do. Microwave links exist to provide a forty-eight voice and one teletype channel link between Suwon and Pyongtaek as well as a one-hundred-twenty voice channel and four teletype channel link between Osan and Pyongtaek. The troposcatter/microwave system inter-connects with the Eighth Army microwave and with the Blue Fortune microwave system.

F.12 Air Defense Microwave System

Project Blue Fortune provides a six hundred channel broad band, fixed microwave telephone and teletype capacity between the aircraft control and warning radar sites, the major ROKAF bases (except for Kimpo and Kimhae), the Air Defense Direction Center and the ROKAF Headquarters. The Blue Fortune system connects with the Air Defense communications troposcatter/microwave system at Pyongtaek, Osan, Kunsan and Juliett. The system includes the following channel links:

TABLE F-1

CHANNEL LINKS

50X5

[redacted]

F.13 While the Blue Fortune System certainly represents a considerable improvement over the use of outmoded radio relay equipment, the system was engineered to meet 1964 requirements under austere conditions. As a result, the system does need upgrading. A fourteen channel expansion was approved within the CIGCOREP package linking the Tactical Air Control Center at Osan with the various counter-infiltration groups north of Seoul and with the ROKN base at Chinhae. As a result of the current deficiencies in the Blue Fortune system, an increase of $515,000 to the prior year MAP program for Korea has been authorized for system improvements. At the time of this writing, plans have yet to be finalized as to the specific channel demands.

F.14 Radio Relay System

For communications to those bases not covered by the Blue Fortune microwave system, a radio relay system of nine terminals and five relays provide AN/TRC-1 voice and teletype VHF channels. The terminals include: Kimhae, Pohang, Taejon, Kunsan, Kimpo, Seoul, and Pusan.

F.15 AC&W Single Side Band Net

The AC&W single side band net consists of a single sideband station at each of the AC&W radar sites with net control located at the Osan TACC. The Air Defense back-up system consists of twenty-four AN/GRC-41 HF radio vans located two each at the eight AC&W sites and one each at the eight major air bases. The back-up system is limited in channel capacity, but does provide alternative routing to the Microwave and Troposcatter systems.

In summary, the ROKAF point-to-point communications has suffered from poor quality communications, primarily due to the low skill levels of ROKAF maintenance personnel and to the lack of apron availability at the outlying locations. Improvements have been made of late in the latter area through the delivery of critical spares by helicopters. Nevertheless, the Korean point-to-point communications system is only marginally capable of providing the necessary intersite communications required to meet an overt air attack threat.

F.2 Tactical Air Communications

The Joint US/ROKAF Tactical Air Control Center is located at Osan and serves all air defense elements in the Korean Air Defense sector. The Combat Reporting Centers and Army Air Defense Command posts for Korea are located jointly at Mangilsan for the northern subsector and at Palgongsan for the southern sector.

Unfortunately, the present manual control system and insufficient scopes available to the air defense systems permit the maximum control of only about ninety-six aircraft at any one time, or 384 in flights of four. The manual nature of the control system also precluded the utilization of the automatic data provided from the AC&W sites and from the air defense surveillance radars. As a result, delays of three to five minutes are involved in identifying any aircraft as hostile.

Secure inter-service communications between ROK military units are presently limited. Improvements are being made as a result of the CIGCOREP counter-infiltration package. Especially critical is the installation of communications from ROKN patrol craft and coastal radars to the Osan TACC in order to provide an alert capability for an NKAF attack at low altitude from the West of P-Y-Do over the Yellow Sea.

The illustrative TACCAP deployment capability of eight and two-thirds wings to the Korean sector in the event of hostilities represents an overwhelming burden to the current ROKAF and US communications capability. In addition, the current Osan TACC would be unable to provide the necessary warning, control, and intelligence direction needed to control this large forge together with the projected ten ROKAF squadrons. Automatic data links would be essential between deployed CVAs in the Sea of Japan and an upgraded Osan TACC. Finally, communications from Osan to forward air strike or reconnaissance aircraft over North Korea could not be accomplished presently without additional relay aircraft along the attack route.

F.3 <u>Other In-Country Communications</u>

The following special communications facilities exist in Korea to facilitate command of U.S./ROK activities:

a. <u>Green Hornet</u>: The Green Hornet is an unclassified telephone net, utilizing standard telephone instruments with no dial capability. This limited user, high priority telephone system serves major commanders, key staff officers and their operations centers.

b. <u>FALCON RWI Facility</u>: The FALCON RWI Facility is an unclassified radio-wire integration (RWI) facility utilizing FM voice push-to-talk operation. There are two types of stations - RWI stations at the radio-wire integration points and mobile stations. The FALCON RWI Facility users are comprised of the Commander, U.S. Forces in Korea and special staff officers. No other stations except those specifically authorized may utilize this facility, except on an emergency basis.

c. <u>Vanderbilt RWI Facility</u>: The Vanderbilt RWI Facility is an unclassified radio-wire integration (RWI) facility, utilizing FM voice push-to-talk operation. This facility differs from the FALCON RWI Facility in that the Vanderbilt RWI Facility may be used by all commanders and staff officers requiring such facilities who are not authorized to enter the FALCON RWI Facility.

F.4 <u>Command and Control Communications</u>:

<u>USA STRACOM Backbone Microwave Communications:</u> The Korean Backbone system provides 240 channels of communications from Seoul to Taegu and an additional 120 channels from Changsan to Taegu. Out-of-country communications include sixty troposcatter channels from Taegu to Itazuke, Japan, supported by VHF back-up. High frequency radio facilities are also available from Taegu to CINCPAC.

The several links of the Backbone system were manufactured and installed by differing foreign and commercial sources. The system also includes several types of military communications gear. The entire system does not meet Defense Communications System standards. Finally, the system does not have the channel capability or quality performance to handle out-of-country message and data demands imposed during a crisis period. The Itazuke-Kanto Plains troposcatter path on the Japan link was found to be especially lacking in channel capacity during the Pueblo crisis. As a result of these incidents, an additional satellite communications terminal is planned for Korea for mid-1970 in addition to the present terminal at Seoul.

<u>Autodin:</u> An Autodin capability is operational at the Taegu DCS and the Seoul DCS facilities. Additional facilities are scheduled for Osan and Kunsan in 1969. CINCPAC has also proposed an automatic Autodin switch at Taegu.

<u>AUTOSEVOCOM:</u> The DCS secure voice communications system is capable of transmitting highly classified information including SIOP. Phase I of the system is now being implemented and will provide communications between key staffs throughout Korea, including the Embassy. Switchboards are located at Seoul, Osan and Taegu. By 1970, the system will provide automatic switching and interconnection with AUTOVON.

F.5 <u>Further Studies in Process</u>

At the request of the JCS, a complete review and validation of the US Force requirements and MAP requirements for communications circuits in Korea was initiated in July 1968. The revalidated requirements are reflected in two separate submissions: one for US requirements and the other for MAP needs. While the demands of US Forces in Korea for improved communications has been developed into an exacting development plan by the Defense Communications Agency, the MAP portion of the validated requirements was submitted only for informational purposes. At the time of this writing, a proposed development plan for the MAP Plan had not been prepared or even contemplated.

The DCA proposal for improved Korea communications includes alternative approaches ranging in cost from $5.4 million for a minimal reconfiguration of the present USAF/MAP system to four $52 to 48 million alternative proposals for a reengineered system. The reconfiguration of the present US/MAP system would provide only between 33% and 73% of the systems performance characteristics demanded in Korea. Each of the other four alternatives will provide 100% of the needed performance characteristics with varying degrees of reliability, flexibility, survivability, and cost-effectiveness.

The Communications-Electronics requirements for Korea are being analyzed and costed as a separate tri-service section of this Study. Even though this air section will not endeavor to distinguish the costs of the DCA proposed program related to the air mission (such a cost inference related to USAF activities only is considered impractical), Table F-2 on the next page lists the requirements and priorities for Priority 1-3 circuits to support USAF activities in Korea.

TABLE F-2

USAF CIRCUIT REQUIREMENTS IN KOREA

	NATURE	COMUSK PRIORITY (where approp)	NUMBER OF CIRCUITS	TYPE	CONNECTIONS TO
1.	Air Force Command and Control	1	12	Voice	Emergency Action Elements
2.	ROKAF/USAF Air Defense and Tactical Air Control System	1C	46	Voice	Radar Sites, control and reporting centers nine air bases and the Osan TACC.
3.	AUTODIN	1H	9	Data grade complex	Nine air bases to Camp Drake, Japan
4.	Tactical teletype network		20	Secure tele-type	Air defense and tactical air force units throughout South Korea
5.	Operational command, intelligence, and air traffic control	1F	10	Voice	USAF units and other UN Command activities
6.	Airlift control	2B	6	Voice	Airlift Control Center at Osan to Airlift Control Elements
7.	Maintain status of radar, navigational aids, and communication		12	Voice	NCMD to reporting and control activities
8.	Tactical command	1A	8	Voice	Air Force Command activity at Osan to their eight combat air elements
9.	Tactical and air defense control	1AA*	289	Tele-type Voice	All elements of the tactical air control system
10.	Air movement and air traffic regulation		68	Tele-type Voice	Air Route Traffic Control Center with nine air bases and GCI radars
11.	Weather collection and reporting		39	Tele-type	Weather observation stations to Osan with disseminations to nine airfields
12.	Augmentation to the Tactical Air Control System		49	Voice	Inter-connections between tactical switch boards, administrative switch boards, and DCS Korea circuitry
13.	Alternative TACC at Taegu		187	Tele-type Voice	Taegu to all airfields and AC&W sites
14.	Advanced command advisory activity		50	Tele-type Voice	Airborne aircraft and other USAF elements in Korea
15.	Support agency communications		68	Voice	Third and fourth circuits between administrative activities

* 86 circuits

A comparable summary of the ROKAF Priority 1-3 communications circuits requirements is reflected in Table F-3 below.

TABLE F-3

SUMMARY OF ROKAF COMMUNICATIONS REQUIREMENTS

50X5

Priority	
1A	[redacted]
AA	
1B	
1C	
1C	
1D	
1E	
2B	
2C	
2D	
2E	
3B	
3C	
3E	

APPENDIX G: LOGISTICS

G.1 General

Logistical support to Korea could be required in a wide range of contingencies varying from ROK engagement of North Korean incursions to a joint U.S./ROK defense against a combined North Korea and the People's Republic of China attack.

The capability of the U.S. to furnish logistic support to Korea must be investigated in two contexts: that related to the strategic airlift and sealift capability of the U.S. to move the necessary logistical support to Northeast Asia, and the internal capability of the logistical facilities in Korea to meet intra-theater requirements.

G.2 Strategic Airlift and Sealift to Korea

The total airlift and sealift capability of the U.S. to Korea is sufficient to meet total U.S. and ROK requirements for support even against a combined North Korean-CPR attack against the Republic of Korea. The critical constraints in the logistic system are intra-theater redistribution of critical supply categories such as POL. Based on the pre-stockage of 45 days of operating requirements for U.S. and ROK forces in Korea, the JCS MOVECAP Study* concluded that 60 day stocks for U.S. forces could be reestablished within D-90 days and for ROK forces within D+150 days.** The cumulative required levels of supply (in short tons) for the U.S. and ROK forces are displayed below (in thousands of short tons):

TABLE G-1

ILLUSTRATIVE SUPPLY REQUIREMENTS

Requirements	D+30	D+60	D+90
MOVECAP requirements for U.S. and ROK forces	366.6	1,433.5	2,359.9
Requirement to provide Class I supplement ROK forces (not in MOVECAP)	13.9	28.4	43.3
Sub-Total	380.5	1,461.9	2,403.2

* Strategic Movement Capabilities Study FY 1969 to FY 1973, December 1967.

** The MOVECAP Study did not include requirements for providing Class I supplies to the ROK or for supporting the dislocated Korean population.

If the U.S. were to use emergency ship requisitioning, without recycling, and the CRAF fleet, the resupply capability to Korea under emergency conditions would exceed requirements, even if a large US force needed to be supplied, as indicated below in Table G-2. Under normal resupply conditions without the requisitioning of ship bottoms, sufficient capability exists for the U.S. to support the ROK forces (with the present level of U.S. forces and advisors) against the North Korean threat alone, as portrayed (in thousands of short tons) below:

TABLE G-2

MAXIMUM RESUPPLY CAPABILITY

	(Thousands of Short Tons)		
Total Resupply Capability	D+30	D+60	D+90
Airlift	110.8	211.3	301.3
CRAF airlift 1/	47.0	94.0	141.0
Sealift 2/	182.5	1,794.7	2,025.4
Sub-Total	340.3	2,100.0	2,467.7
Excess of Supply Capability over Requirements	40.2	638.1	64.5
Normal Resupply Capability			
Airlift	110.8	211.3	301.3
Sealift 3/	44.7	378.2	645.1
Sub-Total	155.5	589.5	946.4
Net Excess of Supply Capability over Requirements	127.7	1,143.3	1,008.3

1/ Based on Strategic Airlift Study, AFCSA, dated May 1, 1968, which utilized the estimate of CRAF made by OASD/SA.
2/ Assumes that 100 cubic feet equals one short ton equivalent.
3/ Assumes that 100 cubic feet equals one short ton equivalent.

G.3 In-Country Logistics Capability

The sealift capabilities and harbors in Korea are limited by strong tide conditions, especially along the West Coast, and by the shallow nature of many of the existing harbor facilities. Nevertheless, the harbor conditions in Korea are not an impediment to the resupply of U.S. and ROK forces as shown by the daily port capacities listed on the following page:

TABLE G-3

PORT THROUGHPUT CAPACITY[1/]
(Short/Tons/Day - General Cargo)

Ports	Throughput Capacity/Day
50X5 [redacted]	50X5 [redacted]
TOTAL	

1/ Information compiled by Eighth U.S. Army, dated September 1967.

The critical element in the sea movement of cargo is the lack of suitable port storage facilities. For instance, the major port of Pusan has only approximately 45 acres of open storage, 216,000 cubic feet of cold storage, and 3,000,000 square feet of covered storage. In the event of hostilities, it is doubtful that the port of Inchon could be relied upon for resupply of U.S. and ROK forces. The total average daily capacity of the four major ports (74,757 short tons) which would be used in the event of hostilities, Pusan, Masan, Yosu, and Pohang, is more than twice the maximum expected average daily off-loading requirement (30,603 short tons) placed upon the four ports in the MOVECAP Study and nearly four times the overall average port workload demand (19,222 short tons) placed upon these four major port facilities.*

Aerial Port Capabilities: The capabilities of the aerial port facilities to move cargo and passengers is highly dependent on the level of harassment

* MOVECAP Study, p. 343.

to the off-loading and storage operations. Assuming undamaged facilities and assuming the deployment of MAC Airlift Control Elements (ACE), the average daily capabilities of the five main aerial ports planned for use in the event of hostilities are summarized as follows (in short tons):*

50X5 [redacted]

The expected movement demands against these five facilities as described in MOVECAP indicate that the aerial capability of supply is highly dependent on secure and unharassed runways and logistics apron space. Without the availability of Kimpo, which appears most reasonable even in the event of hostilities between ROK and DPRK forces only, other airlift flights would need to be diverted to other tactical installations. The aerial off-loading demand forecast in MOVECAP for the above five installations is summarized in Table G-4 below. Of course, these requirements would be reduced considerably if no US troop reinforcement were necessary.**

TABLE G-4

AERIAL OFF-LOADING REQUIREMENTS

	Passengers		Tonnage	
	Total PAX	Daily Average PAX per Day	Total S/T	Daily Average S/T per Day
D-Day to D+4	50X5 [redacted]			
5 - 9				
10 - 14				
15 - 19				
20 - 24				
25 - 29				
30 - 34				
35 - 39				
40 - 44				
45 - 49				
50 - 54				
80 - 89				
150-159				

* Capabilities is used to highlight the off-loading, storage, and transfer rates of the ACE's with Korean National support. The term is not used to denote the physical landing and take-off usage of the base defined as capacity.

** MOVECAP Study, pp. 335-342.

The driving factor of the aerial port usage is the capability to off-load, transfer or store the cargo without harassment or interruptions. Listed below are the sheer physical average daily capacities of the air-fields to land the needed tonnage per se (in short tons):

50X5

[redacted]

The critical issue in aerial port handling, therefore, becomes one of providing sufficient air defense and counter-insurgency support to permit uninterrupted logistics operations at the South Korean airfield facilities. The intra-theater airlift capability will be enhanced significantly during the FY 1970 to 74 period due to the replacement of C-130A aircraft with the C-130E version. The allowable cabin loads for the two aircraft will permit an increase in delivery capability from 8.3 tons to 14.1 tons per flight.

Railroads: The most important means of long distance transporation in South Korea is by railway. South Korea has approximately 1,850 miles of standard gauge track and 77 miles of narrow gauge track. Aside from the 280 mile portion of double track between Pusan and Seoul, the remainder of the South Korean lines are entirely single track. The South Korean railway system has doubled its traffic usage during the decade between 1955 and 1965 as portrayed in Table G-5 on the following page:

TABLE G-5

RAIL FREIGHT TRAFFIC

(Tonnage transported in millions of short tons, except daily average)

Calendar Year	Commercial	Military	Railroad Service	Total	Daily Average (Short Tons)
1955	5.0	4.0	1.4	10.4	28,493
1956	5.6	4.0	1.4	11.0	30,136
1957	7.0	3.7	1.3	12.0	32,877
1958	7.3	3.4	1.4	12.1	33,151
1959	9.0	3.2	1.5	13.7	37,534
1960	10.2	2.8	1.4	14.4	39,452
1961	11.1	2.9	1.4	15.4	42,192
1962	13.1	2.4	1.4	16.9	49,041
1963	15.7	2.3	1.8	19.8	54,247
1964	16.8	2.1	1.4	20.3	55,616
1965	--	--	--	22.4	61,370
1969 (est) 1/	--	--	--	30.5	83,650

1/ Based on average yearly rate of increase for years 1961 through 1965.

The available moving stock in South Korea is as follows:

TABLE G-6

ROK RAIL EQUIPMENT[1/]

	Capacity/Car (Short Tons)	Quantity	Total Capacity (Short Tons)
Locomotives			
Steam	N/A	216	N/A
Diesel	N/A	170	N/A
Sub-total		386	
Coaches - All Types	N/A	1,357	N/A
Freight Cars			
Box	15	87	1,305
Box	30	1,822	54,660
Box	40	1,924	76,960
Gondola	15	77	1,155
Gondola	30	2,288	68,640
Gondola	40	2,543	101,720
Flat	30	300	9,000
Flat	40	303	12,120
Reefer	30	102	3,060
Reefer	40	82	3,280
Tanker	30	176	5,280
Tanker	40	617	24,680
TOTAL		10,302	361,860

1/ DIA South Korean Rail Report, 8 June 1967.

It should be noted that many of the gondola and box cars above do not meet normal U.S. safety standards for shipping munitions. Under normal circumstances, therefore, the shipment of munitions must be by highway. The MOVECAP Study investigated the critical links of the Korean railway network to overloading by use of a linear programming model. Unfortunately, the MOVECAP results did not disclose the dual solution to the problem. This dual solution would have shown the value which U.S./ROK should be willing to pay to raise the constraints on the links below:

RR Line Kimchon-Taejon (39,000 S/Ts/Day)
RR Line Youchon-Ulsong (8,160 S/Ts/Day)
RR Line Kimchon-Ulsong (5,700 S/Ts/Day)
RR line Mokchompo-Taejon (8,160 S/Ts/Day)

The total average capacity of the railway system was 60,790 tons daily. It should be noted that the Kimchon-Taejon node above is along the main north-south route between Seoul and Pusan. The addition of the port of Inchon with an assumed discharge of 9,000 tons increased the average capacity of the South Korean railway to 70,020 tons daily.

Highways: The South Korean highway consists of approximately 15,500 miles, of which 3,550 belong to the national highway system. Approximately 14,500 miles of the network is constructed of crushed-stone or gravel; concrete and bituminous surfaces comprise about 500 miles; and the remaining 550 miles are earth roads only. On the basis of information furnished by the 8th Army, listed below is the capacity of various links of the main Korean highway system:

TABLE G-7

ROK HIGHWAY CAPACITY

Principal Highways	Capacity S/T (Each Way Daily)	Bridges
Rt. 1 - Seoul-Pusan	1,476	282
Rt. 1A - Pusan-Ulsan	1,365	21
Rt. 2 - Inchon-Wonju	822	37
Rt. 13 - Seoul-Masan	1,476	100
Rt. 17 - Chunchon-Yosu	1,230	162
Rt. 20 - Suwon-Kangnung	1,440	63
Rt. 21 - Chonan-Mokpo	1,845	63
Rt. 24 - Yoju-Kansone	1,107	40
Rt. 29 - Chunchon-Pohang	1,472	115
Rt. 40 - Kwangju to A.B.	515	--

Once again, the MOVECAP Study investigated the critical nodes of the South Korean highway system under adverse weather conditions by means of a linear programming model. The total average daily capacity of the highways were determined to be 8,693 tons per day, with the following critical bottlenecks:

Pohang-Ulchin	(1,312 S/Ts/Day)
Ulchin-Yonju	(822 S/Ts/Day)
Chunju-Wonju	(1,472 S/Ts/Day)
Chunju-Chonghowon	(2,427 S/Ts/Day)
Haengdongai-Chonan	(1,474 S/Ts/Day)
Konju-Hongsong	(822 S/Ts/Day)

Even with NKAF air superiority during portions of any hostilities, the South Korean LOC would be degraded by not more than 20%, assuming cuts in the main rail line from Seoul to Pusan for temporary periods. Harassment from insurgents would undoubtedly contribute more significantly to degrading the logistical system as the hostilities progress than NKAF interdiction campaigns. Aside from the critical element of POL supplies, discussed below, the ROK logistical system does have the capacity for meeting U.S. and ROK requirements for total tonnage support.

POL: While the overall question of supporting deployed U.S./ROK forces does not constitute a major constraint in terms of cargo through-put capability to Korea, furnishing POL support to U.S. and ROK forces does represent a critical problem. The average consumption of POL in Korea under peacetime conditions is approximately 600,000 barrels per month with a peak load of approximately 800,000 barrels per month during the winter months. Total wartime POL requirements are estimated at 1.5 to 1.8 million barrels monthly. Storage capacity exists at the locations listed below in Table G-8. All of these facilities are 10,000 barrels above ground tanks of Korean War vintage, and are vulnerable to strafing attack.

TABLE G-8

POL STORAGE

Ocean Terminal	Total Tankage (in Thousands of Barrels)
50X5 [redacted]	
Inland Terminals (MOGAS and DFM only)	
Waegwan	140
Wonju	65
Air Bases	
50X5 [redacted]	

The secondary POL off-loading or terminal facilities on the west coast at Kunsan and Gazan are limited to shallow draft (10,000 barrel capacity) T-1 type tankers. Inchon is not expected to be available to U.S./ROK shipping during early hostilities. The terminal facilities at Pohang and Ulsan on the southeast coast are capable of receiving T-5 tankers which carry 190,000 barrels.

The limited railroad tanker car fleet of the 793 cars is not capable of providing U.S./ROK POL requirements in the event of major hostilities. For this reason, CINCPAC previously secured approval for the construction of an above ground eight inch tactical pipeline primarily to Seoul. This pipeline was justified primarily for wartime use although its peacetime operations are expected to improve the economical distribution of POL supplies for peacetime requirements. The cost of this eight inch line has been approved at $12.37 million in the FY 1968 Supplemental Army Construction Program. The line will be composed of light-weight steel with a throughput capacity of only 27,000 barrels per day. In order to meet the minimum 50,000 barrel daily wartime requirement to support engaged U.S./ROK forces, CINCPAC has recently proposed that the line be increased to a ten inch capacity from Pohang to Osan and that the line be buried. The total estimated cost for the upgraded line would be $21.2 million if approved.

Aside from the hardening programs described below for POL facilities at the Korean airfields, there are no other hardened POL storage facilities in Korea. Considering the susceptibility of the proposed pipeline to air or guerrilla attack, the large investment required for the pipeline alone would not appear warranted unless other hardened forward POL storage facilities are also constructed.

The availability of the key JP-4 storage facilities including construction in progress are summarized in Table G-9 (in millions of gallons):

TABLE G-9

ROK JP-4 STORAGE FACILITIES
(Millions of Gallons)

Location	Existing Unhardened	Hardened Facilities in Process of Construction	Total
Terminals			
Inchon	2.02		2.02
Gazan	3.36		3.36
Kunsan	1.26		1.26
Ulsan	.52		.52
Air Fields			
Osan	1.84	3.78	5.62
Kunsan	2.10	3.78	5.88
Kimpo	.42		.42
Taegu	.84	1.26	2.10
Suwon	1.26		1.26
Kwangju	.84	1.68	2.52
TOTAL	14.46	10.50	24.96

On the basis of the Compton Study* and the PACAF Air Defense Study of Korea, it has been projected that an NKAF air attack directed against the POL terminal and storage facilities, could destroy as much as 80% of the above-ground facilities during the initial day of engagement. Of course, this assumes minimal target acquisition problems and non-effective air defense. The remaining underground storage facilities are not sufficient to sustain the currently programmed ROKAF and USAF engagements for the first 35 days against an attack initiated by the DPRK/CPR, unless sufficient POL resupply can be maintained.** Moreover, the present POL hardening does not represent a balanced posture. Underground storage tanks will exist at only four of the major South Korean airfields. No underground storage will exist at all at Suwon under currently approved construction programs. A summary of ROKAF JP-4 and USAF JP-4 requirements for the initial 35 days of engagements are summarized as follows (in millions of gallons):

* Joint Working Group Report, A Study of Tactical Air Warfare Requirements and Force Effectiveness in the Korean Theater, dtd. 1 July 1968, pp. 6-14-16.

** ROKAF providing major air support alone for first 5 days with major USAF deployment thereafter.

FY 1974 ROKAF JP-4 requirements for first five days considering losses:	.6
ROKAF JP-4 requirements for following 30 days:	5.5
U.S. JP-4 requirements based on TAP CAP redeployments:1/	28.5

JP-4 requirements alone for the following months thereafter are expected to amount to 36.6 million gallons. However, even including terminal facilities and including the highly vulnerable above-ground storage tanks, sufficient JP-4 storage capacity does not exist for the initial 30 days of USAF operations in Korea.

In relation to the cost of the projected POL pipeline, the cost of hardened POL storage facilities is fairly minimal. The cost of the 10,000 barrel storage tank at Kunsan with four foot of earth overlay is projected at $115,000 in the FY 1968 Supplemental Program. The cost for storing 80,000 barrels at the same location in larger tank facilities is estimated at $455,000 in the FY 1969 TABVEE Program. Therefore, the cost of implementing the proposed augmented pipeline capability really provides significant returns when sufficient POL hardened storage facilities are installed at the South Korean airfield facilities.

G.4 ROKAF Logistical Capability

The ROKAF Air Material Depot is located at Taegu and possesses a considerable and improving capability for the overhaul and maintenance of ROKAF aircraft. The depot has performed complete IRAN on the following ROKAF aircraft: F-86, T-33, T-28, C-47, O-1A, and the H-19B. The ROKAF has the capability for component overhaul and updating for the J-85 engines and is installing currently the machine tools for overhauling R-1300 and R-2800-75 reciprocating engines. The ROKAF is awaiting receipt of AGE to complete installation of its F-5A/B component overhaul capability expected early in 1969.

G.5 ROKAF Munitions

The ROKAF does not possess the capability to manufacture air munitions. In the event of hostilities, the ROKAF would be dependent on the U.S. not only for POL, air munitions, and aircraft spares support, but on a wide range logistical assistance required to maintain the ROKAF operations readiness.

1/ Tactical Air Deployment Capability Study - 1973.

Although some construction is in progress, munitions storage and handling facilities are inadequate throughout Korea for air munitions. Tactical missiles and other items of low density and extremely high dollar value are being stored under unsatisfactory conditions such as in wooden frame structures and, in some instances, on open pads. Storage of this type contributes heavily to rapid deterioration of the munitions and adversely affects the materiel readiness and reliability of major components of critical weapons systems. Inadequate storage requires additional care and maintenance for munitions and thus escalates costs. Further, current storage facilities are vulnerable to destruction by sabotage and air attack.

Facilities such as buildings of semi-permanent, pre-engineered construction and earth covered magazines will provide economical storage as well as result in accrued cost reductions through reduced maintenance and handling. Such structures will provide added security against air attacks and protection from guerrilla action. The critical factors in providing proper storage are the increased life, improved reliability and reduced vulnerability of the weapons system involved. ROKAF air munitions status is shown in Table G-10 on the following page.