

LOGISTICS

BY

CAPTAIN (E) D. F. H. CHANDLER, O.B.E., D.S.C., R.N., A.M.I.MECH.E.

Logistics, as a word, has gained currency in the post war years, though it has played a significant part in most wars of history, and as a subject it has increasing interest for the engineer officer.

The fact that logistics very definitely concerns the engineer officer is thought to justify a contribution to the *Journal*. Our use of the word has stemmed from inter-allied planning with United States forces in the latter years of the war.

An American characteristic, in business as in war, is to get results by the most direct methods -cutting out the frills. This characteristic is reflected in a vocabulary which is descriptively colourful, forthright and terse; hence their use of the word logistics which, by definition, means the planning, supply and maintenance of a military operation. Derived from the Greek, the word means literally, 'pertaining to reckoning'.

An operation in war, or an exercise in peace, must have its logistical background, and the logistical plan now features prominently in any Staff planning in the three Services. A fundamental is that the logistic plan must fit the operational plan, but it will be appreciated that the size and tempo of an operation is partly determined by the maximum logistic support which can be made available. The preparation of a naval logistic plan requires a knowledge of fuelling, watering, maintenance and repair of ships and craft, victualling and armament supply. Much of this comes within the engineer officer's province and the contributions to the *Journal* on 'Planning Amphibious Operations', by Commander (E) E. H. D. Williams show how necessary it is for the engineer officer to know something of logistics and to learn lessons from the past.

LOGISTICS IN HISTORY

It has been said that 'history gives depth to time', and the old cliché, 'history repeats itself' is sufficiently true to justify a short survey of the part which logistics has played in earlier battles and campaigns.

Medieval wars were notable for the siege of castles and walled cities, in which the defenders held a strategic and tactical advantage, whereas the besiegers usually held a logistic advantage. For that reason many castles and walled cities were taken, not by direct assault, but by the maintenance of superior logistics which forced a starving garrison to capitulate, unless it could win the logistic battle by a sally to destroy the besieging army's stores, or by a relief force which could cut their supply lines and thereby gain logistic superiority. The centuries of *Pax Romana* were a tribute to the superlative organization of the logistics which supported the Legions throughout the Roman Empire.

More recently, the century of *Pax Britannica* was made possible by logistic support of water, fuel, maintenance, repair, victualling and armament supply, which enabled the British Fleets to keep a vigilant watch in all the Seven Seas.

The 'Golden Horde' of Ghengis Khan demonstrated a new technique of amazing mobility, in the Mongol invasions which swept across Asia to the gates of Vienna. But every campaign was preceded by careful logistic planning. The terrain was surveyed, camps earmarked and pastures allocated before the

mounted armies of Ghengis Khan or Timur the Lame surged forward on the next campaign.

If we do in fact learn more from our mistakes than our successes, then cases of logistic failure should be mentioned.

There is no more humiliating episode in British naval history than the occasion when Van Tromp swept up the Thames and Medway to burn our ships right under our noses, a humiliation which was the heritage of logistic abuse, dockyard corruption and administrative incompetence. Even the Armada result hung poised at a time when our supplies of powder and shot were almost gone, and we depended largely upon what was found in captured Spanish ships. The amount which would be used had been underestimated, and the inadequate supplies were not always where they were wanted ; what we should now call a bad logistic plan.

In contrast, there was Lord Nelson's close blockade of the French fleet which continued throughout the winter gales, and his skillful maintenance, repair and support of the Mediterranean squadrons.

Finally, what are the lessons of Alexander the Great's campaigns, Napoleon's retreat from Moscow, and the German defeat at Stalingrad ? All three were applications of that dangerous principle that war can support war. In place of sound logistic planning, the operations depended upon local resources, captured material and living off the country. Alexander was successful, but it can be claimed that bad logistics were more to blame than tactical errors in the debacle of Napoleon's Moscow and Hitler's Stalingrad.

Naval Logistics in the Second World War

During the last war, logistic support had come to mean the estimation and acquisition of all that a modern fleet required, with ability to supply these requirements in sufficient quantity at the correct time and place.

As the scope and scale of the war increased, logistic support endeavoured to keep pace, modified in character with the growing emphasis on sea/air power and the peculiar complications of amphibious operations.

The Admiralty organization provides for the logistic support of the Fleet through the Board of Admiralty collectively and the Sea Lords individually. The Naval Staff requirements are implemented logistically by the Administrative, Maintenance, Supply and Air Departments under the Second, Third, Fourth and Fifth Sea Lords respectively.

THE FUNDAMENTALS OF LOGISTIC PLANNING

The contribution made by the engineer officer in logistic planning will depend upon the delegation of duties within the Staff, and the particular 'level' upon which he is planning. This is dealt with in great detail in Commander (E) Williams' contribution in 1947 issues.

A certain amount of overlapping is inevitable and is in fact desirable, rather than the danger of gaps left and important details overlooked. The engineer officer will be wise to work in the very closest co-operation with other staff officers, and to keep up to date in all political, strategical and tactical developments concerned, since these developments and implications will have some bearing on decisions which he must make in planning. On no account must the engineer officer consider himself purely technical, for in fact, the success of his planning is some measure of his co-operation with other staff officers and his appreciation of the intended conduct of assault forces, 'order of battle', etc.

The 'Operation' or 'Exercise' will define what the 'Objective' is and give the operational plan in broad terms, stating the forces, ships and aircraft which will be made available.

Logistic planning can commence on this information, progressing as more information becomes available, but it will never be possible to know all that is required, nor is it likely that ample ships, spares, tankers, ammunition ships, and so on can be made available to cover all possibilities and hazards. A marginal allowance must be made for weather, enemy action and late changes of plan. One must in fact, plan on what is known, make an intelligent estimate of unknown factors, and endeavour to make the plan resilient and adaptable enough to match the operational plan.

According to the scale of the operation or exercise, the logistic plan will cover all or some of the following requirements :—

Supplies of fuel of all types, lubricants, water, ammunition, spares, victuals, reserve A/c, stores, clothing ; at Main bases, in Fleet train, at staging ports, forward bases and assault areas.

Repair facilities covering the above bases ; docking, slipping, mobile repair units and beach repair organizations.

Follow up requirements to consolidate on temporary arrangements.

Salvage equipment and special vessels.

Training of special groups, and operational rehearsals.

A shrewd balance must be struck between say, ample supplies of fuel in the assault areas but risk of serious losses, and a shuttle-service of tankers coming forward in the planned convoys, but subject to delays in adverse weather, or to sinkings which may leave an assault area seriously short.

Eventually the logistic arrangements are incorporated in the operational plan, but it is mere wishful thinking to hope that the urgencies of the day will allow Commanding Officers to digest the plan in detail or signal situation reports on matters of administration.

In the Mediterranean operations, which preceded the amphibious assault on the southern French coast, the fuelling arrangements depended upon timely fuel reports from individual tankers, assault areas and fuelling bases. Empty tankers in the assault areas and forward bases were to be sailed in returning convoys and loaded tankers were to be sailed in outgoing convoys. For these arrangements to work smoothly and efficiently, it was essential that Logistic Headquarters received regular and up-to-date signals of the fuel situation. In actual practice it was found that the enormous burden of signal traffic during an operation put logistics signals to the lowest priority, and fuelling replenishments had to be guessed on inadequate information.

For this reason it is considered wise to present significant information in graphical form which Commanding Officers have time to look at, and which can convey the situation at a glance, without recourse to figures and slide rules.

Presentation of the fuel estimates and arrangements in a graphical manner, enables the Flag Officer to grasp the essentials of the fuel plan, when presented for his approval, better than when confronted with pages of complicated calculation. Furthermore, the Flag Officer is able to see at a glance the fuel situation at any time during the assault without recourse to signal, knowing also that the fuel situation is similarly known at the Naval Headquarters, in all assault areas, and at all fuelling bases.

To illustrate the interest of logistic planning, two examples will be given, one being the 'Fuel' part of the logistic plan for operation 'Dragoon', the assault

made on the southern French coast ; and the second a fuel plan based on a hypothetical requirement in the Pacific War.

OPERATION DRAGOON

The objective was to secure bridgeheads on the southern coast of France, from which to capture Toulon and Marseilles by given dates, exploiting the situation in the direction of the Rhone valley.

The forces included an American assault with a French follow-up.

An American Admiral, commanding the U.S.N. 8th Fleet was in command afloat, with various British warships attached to his fleet.

For fuel calculations, the logistic planners had to decide such significant conditions as :—

Average speeds for each class of ship.

Operational availability from D-day.

Fuelling area for each class of ship—assault area, forward base or main base.

From the nature of the particular operation, and the duration of the operational period, it was possible to subdivide the fuel estimates into suitable periods. The duration being estimated at three weeks, it was convenient to divide into weekly estimates in the form shown in Tables I, II and III.

These estimates were plotted as fuel expenditure on a time-base for each type of fuel, in assault areas, forward fuelling bases and main bases. (Graph U). The points plotted thus gave the ' gradient of expenditure ' for each succeeding weekly period, the gradient being steeper at the beginning of the operation than at the end, when expenditure had fallen. The graphic presentation of fuelling arrangements was then developed by adjusting tanker replenishments within certain limitations. Fuel stocks in assault areas and bases had to be maintained above a certain minimum. A straight line drawn on each graph represented the minimum stock to be maintained.

In assault areas and at fuelling bases, the decreasing fuel stock, which is represented by the gradient of expenditure, must be stepped up at intervals to maintain the level above the minimum datum line. The intervals of stepping up or replenishment must coincide with the arrival of convoys in the particular area or base, otherwise special tanker convoys and escorts will be required. The problem of convoys, and the provision of sufficient escorts, is difficult enough without the additional burden of special tanker convoys, which should be avoided except in exceptional circumstances. In other words, the logistic plan must be made to fit the operational plan and not vice versa.

At tanker refilling bases, the refuelling schedules should be arranged so that stocks remain above the agreed minimum, either by limiting the number of tankers to be refilled, or by arranging for non-operational tankers to bring in more fuel, from outside the station or from fuel bases beyond the reach of the operational tankers.

To summarize the information required for making the graphic presentation of the fuel plan, the logistic planner had to obtain the following information from the Staff or make the necessary decisions :-

Number and loaded capacity of all tankers.

Convoy programme.

Expenditure in each area and at each base.

Maximum stocks which could be held.

Convoy speeds and distances.

Minimum stocks to be held.

Fuelling rates at bases.

TABLE I.- *Estimated Fuel Requirements for First Week*

<i>Ships</i>	<i>No.</i>	<i>Days</i>	<i>Speed and Conditions</i>	<i>Finance Tons</i>	<i>Diesel Tons</i>	<i>100 Octane Tons</i>	<i>Coal Tons</i>	<i>Consideration Influencing Estimates</i>	<i>Fuelling Area</i>
Battleships	1	—	48 hours 20 knots	750	—	—	—	Will not require fuel until withdrawn	X
Cruisers	7	7	14 hrs/day—30 knots	17,500	—	—	—	Bombarding or Fire Support or at short notice for full speed cannot fuel further away	A
A-A Cruisers	1	7	24 hrs/day—12 knots	550	—	—	—	Must steam about anchorage and be ready for full speed	B
Escort Carriers	5	7	18 hrs/day—F.S.	—	—	1,000	—	Endurance sufficient for 20 days at F.S. One refill of aviation petrol allowed for	A
Fighter Directors	1	7	18 hrs/day—10 knots	—	100	—	—	If not steaming will be at short notice	B
Destroyers	126	7	24 hrs/day—20 knots	86,000	—	—	—	Constantly on the go for first week and always at short notice for full speed	A, B & C
Trawlers	3	7	—	—	—	—	150	—	C
Fleet M/S	17	7	24 hrs/day—12 knots	2,500	—	—	—	Will be hard at it first week	A & B
Motor M/S	21	7	Ditto	—	—	650	—	Ditto	A & B
L.C.M. (iii)	500	7	12 hrs/day—F.S.	—	4,600	—	—	12 hours loading and unloading 12 hours running	A
P.T.	20	7	4 hrs/day—F.S. 12 hrs/day—C.S.	—	—	700	—	Half the force operating alternate days	Y
L.C.T. (iv)	52	7	12 hrs/day—F.S.	—	620	—	—	—	—
L.C.T. (v) & (vi)	70	7	Ditto	—	700	—	—	Arrive in beaching trim with 500 miles endurance	A
L.S.T.	20	7	—	—	—	—	—	No fuel required	—
L.C.T. (iii)	24	7	—	—	—	—	—	Arrive 1,500 miles endurance at F.S.	—
L.C.L. (I)	35	7	—	—	—	—	—	Arrive 600 miles endurance at F.S.	—

TOTAL 1ST WEEK 107,300 6,020 2,350 150

TABLE II. *Estimated Fuel Requirements for Second Week*

<i>Ships</i>	<i>No</i>	<i>Days</i>	<i>Speed and Conditions</i>	<i>Furnace Tons</i>	<i>Diesel Tons</i>	<i>100 Octane Tons</i>	<i>Coal Tons</i>	<i>Considerations Influencing Estimates</i>	<i>Fuelling Area</i>
Battleships								Battleships withdrawn	—
Cruisers	7	7	14 hrs/day-30 knots	13,000	—	—	—	Reduced bombardment and support fire	A
A A Cruisers	1	7	24 hrs/day-12 knots	550	—	—	—	Continued protection of anchorage ports	B
Escort Carriers	5	7	18 hrs/day-F.S.	—	—	500	—	Operating only 50% of original planes carried	A
Fighter Directors	1	7	18 hrs/day-10 knots	—	100	—	—	Continued protection of anchorage or ports	B
Destroyers	126	7	24 hrs/day-20 knots	64,000	—	—	—	75% fuel required first week	A, B & C
Trawlers	3	7	—	—	—	—	150	—	C
Fleet M S	17	7	24 hrs/day-12 knots	1,850	—	—	—	75% M:S operating in second week	A & B
Motors M S	21	7	Ditto	—	500	—	—	Clearing ports and approaches	A & B
L.C.M. (iii)	500	7	12 hrs/day-F.S.	—	2,800	—	—	60% remaining operational	A
P.T.	20	7	4 hrs F.S. 12 hrs-C.S.	—	—	500	—	70% ditto	Y
L.C.T. (iv)	52	7	12 hrs/day-F.S.	—	460	—	—	75% ditto	A
L.C.T. (v) & (vi)	70	7	Ditto	—	520	—	—	75% ditto	A
L.S.T.	20	7	Ditto	—	1,400	—	—	One refill to beaching limit of 70 tons	A & B
L.C.T. (iii)	24	7	12 hrs/day-F.S.	—	240	—	—	10 tons each craft	A
L.C.L. (L)	35	7	—	—	550	—	—	One refill/craft to beaching trim	A & B
TOTAL 2ND WEEK				79,400	6,570	1,000	150		

TABLE III.—Estimated Fuel Requirements for Third Week

<i>Ships</i>	<i>No.</i>	<i>Days</i>	<i>Speed and Conditions</i>	<i>Furnace Tons</i>	<i>Diesel Tons</i>	<i>100 Octane Tons</i>	<i>Coal Tons</i>	<i>Considerations Influencing Estimates</i>	<i>Fuelling Area</i>
Battleships									
Cruisers	7	7	14 hrs. day 30 knots	9,000	—	—	—	70% second week's exp.	A
A. A. Cruisers	1	7	24 hrs. day 12 knots	550	—	—	—	Continued protection in anchorage or ports	B
Escort Carriers	5	7	18 hrs. day—F.S.	—	—	—	—	Carriers withdrawn	—
Fighter Directors	1	7	18 hrs. day 10 knots	—	100	—	—	Continued protection in anchorage or ports	B
Destroyers	126	7	24 hrs. day 20 knots	44,000	—	—	—	70% second week's exp.	A, B & C
Trawlers	3	7	—	—	—	—	150	—	C
Fleet M. S.	17	7	24 hrs. day 12 knots	1,300	—	—	—	70% second week's exp.	A & B
Motor M. S.	21	7	Ditto	—	350	—	—	Ditto	A & B
L. C. M. (iii)	500	7	12 hrs. day F.S.	—	1,950	—	—	Ditto	A
P. T.	20	7	4 hrs. F.S. 12 hrs. C.S.	—	—	350	—	Ditto	
L. C. T. (iv)	52	7	12 hrs. day F.S.	—	320	—	—	Ditto	A
L. C. T. (v) & (vi)	70	7	Ditto	—	390	—	—	Ditto	A
L. S. T.	20	7	Ditto	—	1,400	—	—	As for second week	A & B
L. C. T. (iii)	24	7	12 hrs. day F.S.	—	170	—	—	70% second week's exp.	A
L. C. A. (I)	35	7	—	—	550	—	—	As for second week	A & B
TOTAL 3RD WEEK				54,850	5,230	350	150		

The fuel logistics were based on the following considerations :—

Fundamentals

All floating and shore tanks to be filled to the prescribed amount.

All ships and craft to leave their terminal ports filled to capacity, except where beaching conditions are imposed.

All ships and craft able to fuel away from the assault area without prejudice, to do so.

Assumptions

A 20 per cent margin should be allowed against loss by enemy action.

Only a limited number of destroyers and escorts to refuel in the assault area, chiefly those providing screen and patrol protection in the assault area.

N.B. Fuelling *all* destroyers in the assault area would require the use of large tankers, an unacceptable risk to tankers and other shipping in the area. A burning tanker would make an unmistakable 'beacon' for enemy aircraft attacking after dusk. Burning fuel might spread to other ships.

Remaining destroyers and escorts to fuel at convoy terminal ports and/or be detached to refuel at suitable forward ports.

The take-off of furnace and Diesel fuel in the assault area to be small during D-Day to D plus 2, since :—

- (a) Destroyers in area should all have ample endurance until then.
- (b) L.C.T. Mark IV, V and VI should all arrive with about 300 miles endurance. L.C.T. Mark III with 1,500 miles endurance.
- (c) L.S.T. should all arrive with over 1,500 miles endurance.
- (d) L.C.L(L) should all arrive with over 500 miles endurance.

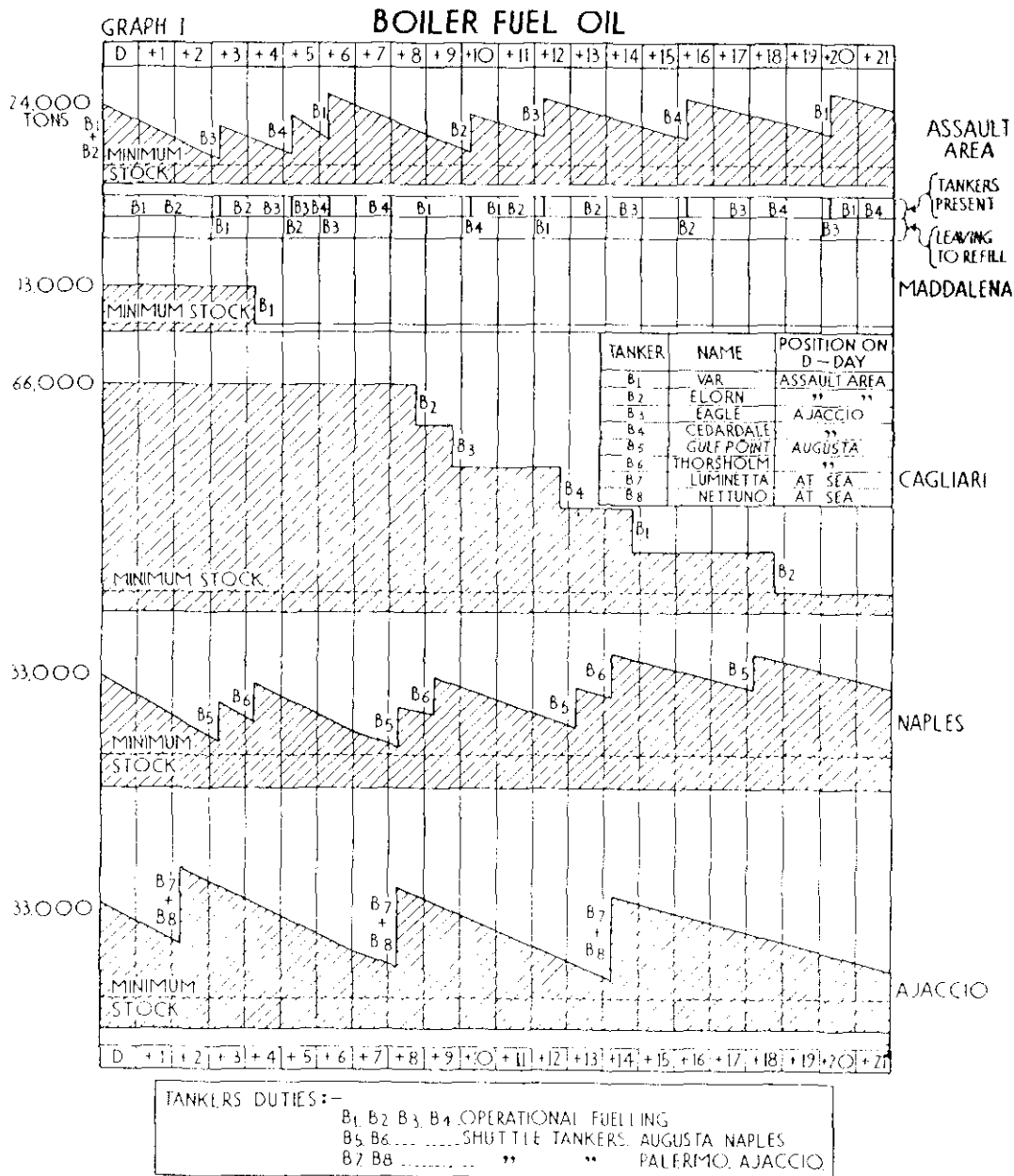
L.S.G. to be available for fuelling in the assault area until D plus 4 and, when withdrawn, discharge any appreciable quantity of fuel remaining, not taking it away from the forward area.

C.V.E. (Escort Carriers) to be sent in to refuel with 100 octane gasoline when the escort carrier force is withdrawn to seaward during the night.

Shore fuel stocks in forward ports to be maintained by tankers 'shuttling' forward from rearward ports having reserves.

The fuelling part of the logistic plan was then completed, ready for approval and inclusion in the operational orders, setting out the schedule or time-table for each tanker. Each tanker was then informed of the convoys in which to sail, the destinations, the return convoys for replenishing, and the refuelling destination. The advantages of these arrangements were obvious: tankers knew where to go, when to leave, where to refill and where to return, without the need for signals or reference to Naval Commanders. The final action was to initiate signals to each tanker, repeated to all interested authorities, ordering tankers to load certain fuels and lubricants, and sail to arrive at a certain port by a certain date. Security was fully preserved, in that individual tankers did not know their operational use or destination until handed the operational orders immediately prior to leaving in the 'assault' or 'follow up' convoys.

Tables I, II, III and Graph I represent the fuelling arrangements for the South of France. The chief considerations governing the fuel plan were that the main fuel stocks in the Mediterranean were at Palermo and Augusta, a central disposition best suited to meet any operational needs in the Eastern, Central or Western Mediterranean.



SIMILAR GRAPHS FOR DIESEL, 80 OCTANE PETROL AND 100 OCTANE PETROL

(GRAPH I)

The distances involved in this operation made it impossible for ships other than returning convoy escorts to fuel further away from the assault area than Corsica. This fact necessitated tankage being erected at Ajaccio. Limited stocks were available for refilling tankers at Cagliari and Maddalena, so that it was essential to run two continuous tanker shuttle services, between Augusta and Naples, and between Palermo and Ajaccio. These shuttle services maintained a flow of fuel from the more distant large fuel stocks, to the convoy terminal port of Naples and the forward fuelling base at Ajaccio, where expenditure was very heavy.

There are many other considerations affecting this particular operation which are irrelevant to the general presentation of the fuelling plan, but in conclusion it should be emphasized that unexpected losses and emergencies were covered

by holding four fast ocean tankers which were available to go forward to meet any unforeseen fuel situation.

In the event of unexpected losses it was then possible to send a signal *on the highest priority*, calling forward a high-speed tanker, for which special escorts would be made available.

**FUELLING A PACIFIC TASK FORCE FROM MOBILE OILER GROUP
—A HYPOTHETICAL CASE**

The main fleet base is at Truk Island. The operational area of ships based on Truk is a circle centred on Truk, of radius equal to half the 'endurance' of the ships concerned. This radius is 1,500 miles.

The C.-in-C. wants to operate the Task Force from an advanced base 1,500 miles from Truk. The advanced base selected is Ganges Island.

The Task Force and the estimated monthly fuel consumption is:—

5 Battleships	25,000 Tons
3 Aircraft Carriers	25,000 „
15 Cruisers	30,000 „
36 Destroyers	26,000 „
21 Submarines	2,100 „
		108,100 Tons

No shore tankage will be available at Ganges Island and all fuel stocks must be afloat. C.-in-C. decides that there must always be at least two weeks' reserve of fuel at the advanced base, in addition to what is in the O.F. tanks of the Task Force. The Task Force based on Ganges Island will keep topped up with fuel at all opportunities. The Force is expected to use one week's fuel allowance on passage and will take seven days on passage.

Escorts can be provided for convoys leaving Truk every seven days. The first tanker convoy will accompany the Task Force from Truk to Ganges on 'zero' day. On arrival at Ganges, the escorts will remain one week and return to Truk when the next convoy arrives, escorting the empty tankers no longer required at the forward bases. The passage to the advanced base takes about six days.

The Fleet tankers can load 7,500 tons; 500 tons margin allowed for gales, diversions and delays, so that Fleet tankers can be considered as 7,000 tonners.

They burn 15 tons for every 100 miles steaming and 10 tons/day in harbour.

Six small attendant oilers, of 4,000 tons loaded capacity each, are available for advanced base duties. They carry sufficient Diesel fuel in addition, for passage and harbour duties.

Plan 1

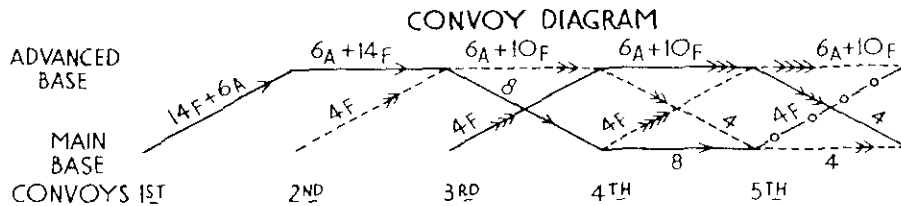
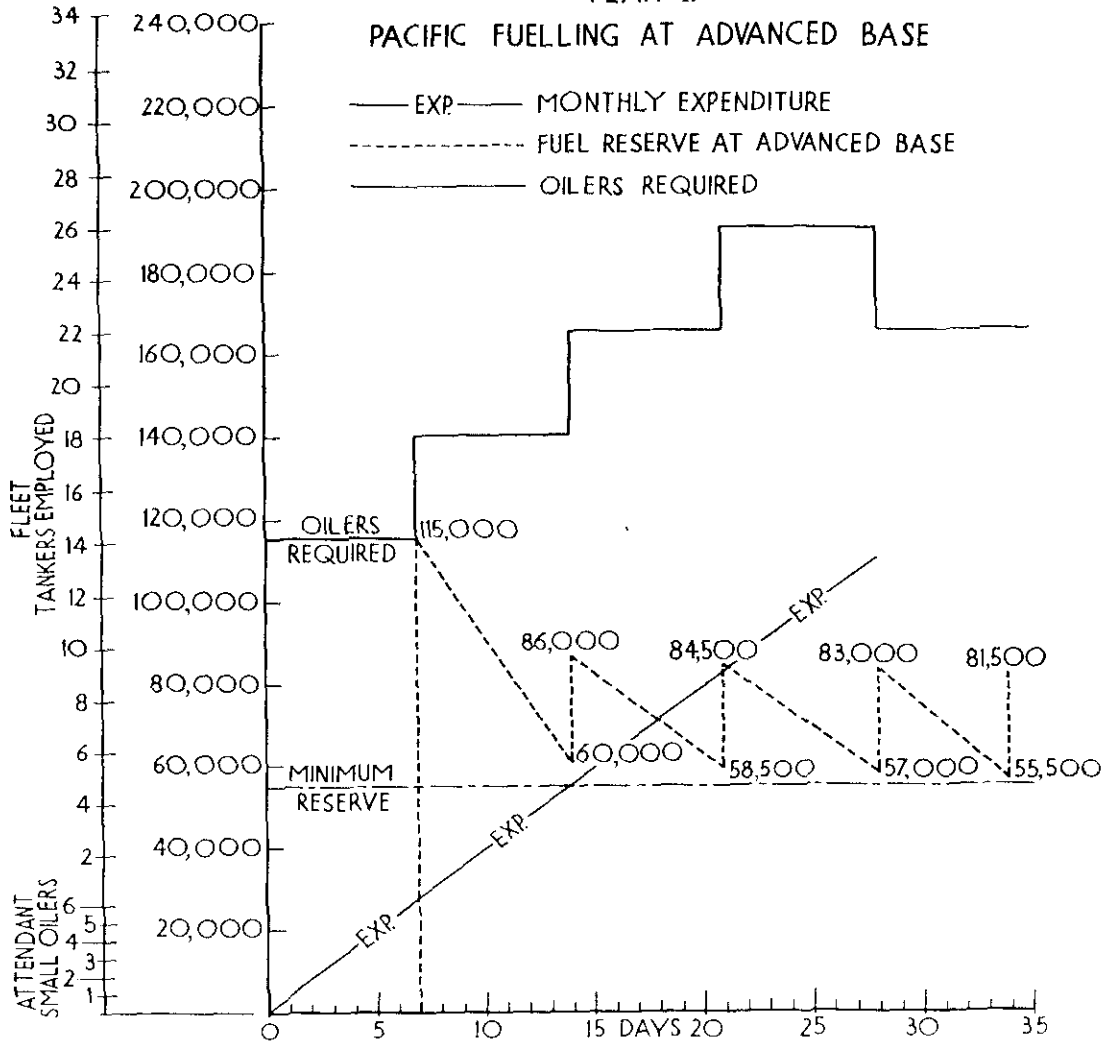
Requirement

A convoy programme, 1st week to 5th week, with number of oilers in each convoy.

The number of oilers required to maintain supplies at advanced base for first 35 days.

The fuel reserve available at advanced base for the first 35 days.

PLAN I.
PACIFIC FUELLING AT ADVANCED BASE



(PLAN I)

Plan II

Assuming insufficient oilers are available at the main base initially to carry out Plan I. Only six fleet and six attendant oilers are available on 'zero' day.

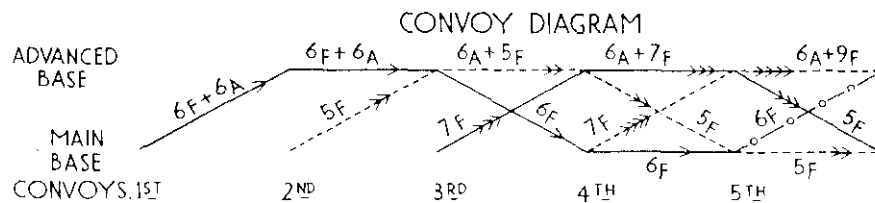
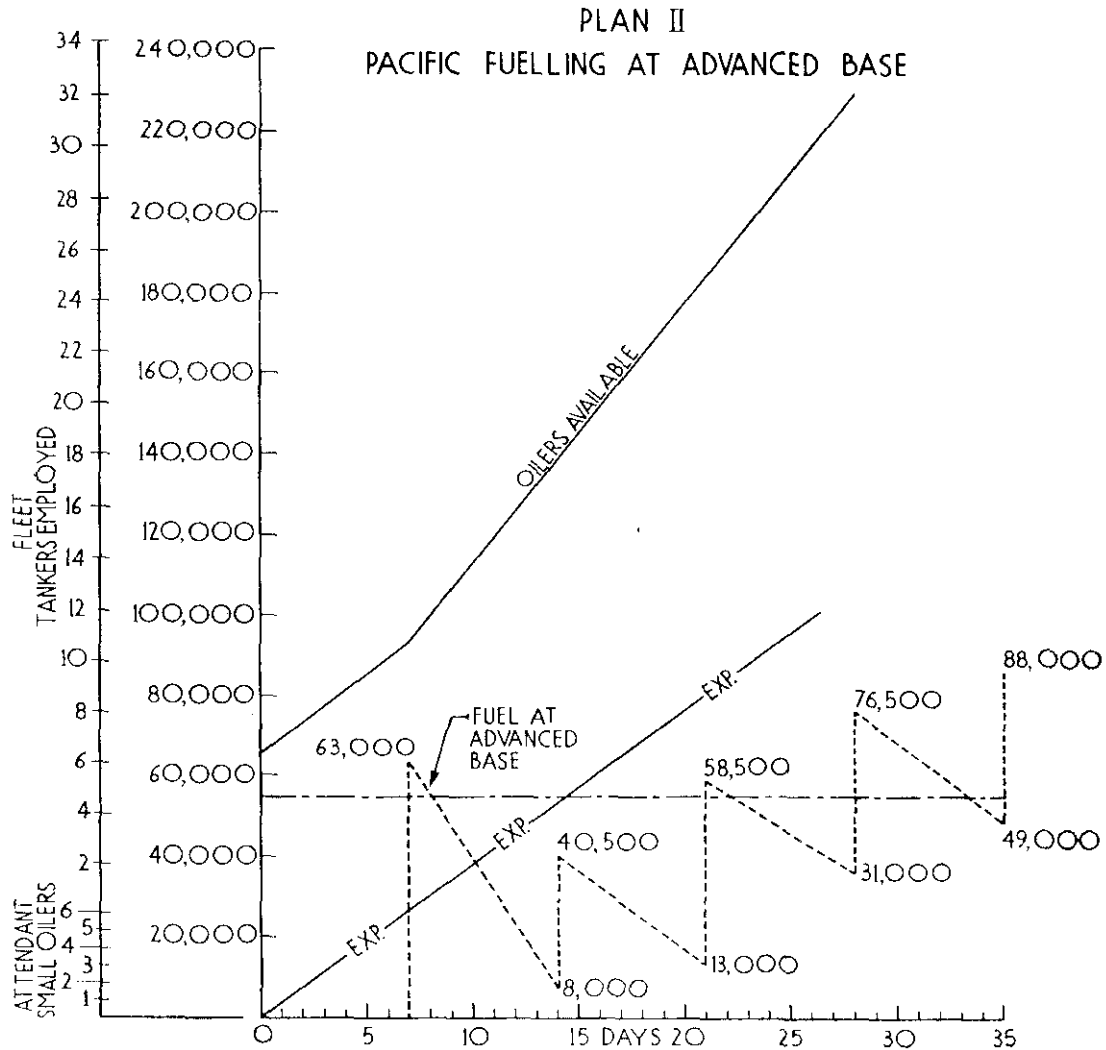
Five more fleet oilers will become available during the 1st week. After that fleet oilers will arrive at the main base at the rate of one per day until the 28th day, i.e. oilers allocated from the East Indies Command are beginning to arrive.

Requirement

Convoy programme, 1st week to 5th week, with numbers of oilers in each convoy.

Number of oilers available from zero to 28th day.

Fuel reserves available at advanced base for first 35 days.



(PLAN II)

Fuel Plan

Each fleet oiler will have to steam about 3,000 miles and spend seven days at the advanced base. This requires about 500 tons of fuel so that the delivery capacity of each fleet oiler can be considered as about 6,500 tons.

The Task Force consumes about 110,000 tons per month. Two weeks supply must always be held in reserve, i.e. 55,000 tons.

Six attendant oilers can hold 24,000 tons.

Five fleet oilers can hold 32,500 tons.

A convoy leaving Truk on zero day would reach Ganges on the 7th day, leave on 14th day and arrive back at Truk on the 21st day. Its second round trip would commence on the 28th day.

Plan I

In Plan I, the Task Force must take with it as a minimum, two weeks' reserve fuel (55,000 tons), plus its normal expenditure until the arrival of the next convoy (55,000 tons), a total of 110,000 tons.

The 1st convoy thus comprises :—

6—4,000 tonners = 24,000 tons.
14—6,500 „ = 91,000 tons.

2nd convoy —4 Fleet oilers.
3rd „ —4 „ „
4th „ —4 „ „
5th „ —4 „ „

Oilers employed are :—

1st week—6A + 14F
2nd „ —6A + 14F + 4F
3rd „ —6A + 14F + 4F + 4F
4th „ —6A + 14F + 4F + 4F + 4F
5th „ —6A + 14F + 4F + 4F + 4F + 8F + 4F

Plan II

1st convoy 6A + 6F
2nd „ 5F
3rd „ 7F
4th „ 7F
5th „ 6F

Oilers employed are :—

(A = attendant oiler)
(F = fleet oiler)

1st week—6A + 6F
2nd „ —6A + 6F + 5F
3rd „ —6A + 6F + 5F + 7F
4th „ —6A + 6F + 5F + 7F + 7F
5th „ —6A + 6F + 5F + 7F + 7F + 6F.

The inference drawn from Plan II is that the Task Force must operate on a reduced scale for the first 28 days, if fuel reserves are to be kept above 55,000 tons.

If the Task Force is to have full operation, the fuel reserves will be below 55,000 for the first 28 days, but will at no time be less than two days fuel expenditure, i.e. 8,000 tons.

This presentation of plan may lead to consideration of special escorts for a mid-week convoy, which would maintain reserves at a higher figure during the early weeks of Task Force operations.

Plans such as these are based on the data given, and the operational intentions, but all plans must be sufficiently flexible to react to operational changes and the possible effects of enemy action.