R-851-PR

February 1972

Operation "STRANGLE" (Italy, Spring 1944): A Case Study of Tactical Air Interdiction

F. M. Sallagar

A Report prepared for

UNITED STATES AIR FORCE PROJECT RAND

Rand

SANTA MONICA, CA. 90406

This research is supported by the United States Air Force under Project Rand—Contract No. F44620-67-C-0045—Monitored by the Directorate of Operational Requirements and Development Plans, Deputy Chief of Staff, Research and Development, Hq USAF. Views or conclusions contained in this study should not be interpreted as representing the official opinion or policy of Rand or of the United States Air Force.

R-851-PR

February 1972

Operation "STRANGLE" (Italy, Spring 1944): A Case Study of Tactical Air Interdiction

F. M. Sallagar

A Report prepared for

UNITED STATES AIR FORCE PROJECT RAND

Rand

SANTA MONICA, CA. 90406

Bibliographies of Selected Rand Publications

Rand maintains a number of special subject bibliographies containing abstracts of Rand publications in fields of wide current interest. The following bibliographies are available upon request:

Aerodynamics • Arms Control • Civil Defense
Communication Satellites • Communication Systems
Communist China • Computer Simulation • Computing Technology
Decisionmaking • Game Theory • Maintenance
Middle East • Policy Sciences • Program Budgeting
SIMSCRIPT and Its Applications • Southeast Asia
Space Technology and Planning • Statistics • Systems Analysis
USSR/East Europe • Weapon Systems Acquisition
Weather Forecasting and Control

To obtain copies of these bibliographies, and to receive information on how to obtain copies of individual publications, write to: Communications Department, Rand, 1700 Main Street, Santa Monica, California 90406.

Published by The Rand Corporation

PREFACE

This case study of tactical air interdiction was done under the Rand Tactical Studies Program, which is part of a USAF-sponsored inquiry into the conceptual, operational, and technical aspects of major Air Force missions. The World War II Allied air campaign in Italy, Operation STRANGLE, was chosen because it was an important milestone in the evolution of interdiction doctrine and therefore might explain the origin of concepts that have been retained as part of current doctrine. The purpose of the study was to yield insights into the validity of those concepts; historical material was included only as needed to provide a concrete setting in which to explore them. It was not the author's intent to write another history of the campaign.

The prevailing concepts of the role airpower should play, and of the manner in which it should be employed and controlled, largely governed its effectiveness in World War II, as they will in future conflicts. The tools available to a field commander and the approved concepts for their use are the result of long-range planning for force procurement and employment. The planning reflects official doctrine which, in turn, rests on past experience that must be periodically reexamined to test its validity in a changing environment. The present inquiry into the origin of the concepts for tactical air interdiction may therefore prove useful to force-structure planners in DCS/Plans and Operations, as well as to tactical field commanders and their staffs.

A preliminary version of this Report was given limited distribution within the United States Air Force. The present, slightly amended version is the final report on the study.

SUMMARY AND CONCLUSIONS

STRANGLE was conceived and conducted as an independent air operation, designed to force the withdrawal of the German armies from central Italy by denying them essential supplies. Although the Allies were preparing a major ground assault on the German positions (Operation DIADEM) at the time the interdiction campaign was in progress, the Mediterranean Allied Air Forces (M.A.A.F.) believed, or hoped, that the effects of STRANGLE would make the ground offensive unnecessary or turn it into the mere pursuit of a retreating enemy. This hope was not fulfilled; but, as it turned out, interdiction made a major contribution to the success of DIADEM in a way not generally foreseen.

When it was recognized, near the end of STRANGLE, that the original objective was not likely to be attained, the Allies decided that the best contribution the air could make to the ground offensive was to continue the interdiction campaign during DIADEM as a major effort, except for the sorties devoted to close air support and to maintaining the air superiority that had already been achieved. Supply denial remained the objective for the new phase of the campaign, and was expected to be more easily attainable in view of the increased consumption that would be imposed on the German armies during the Allied ground assault.

Although the objective was still the same during the DIADEM phase as it had been during STRANGLE, there were changes in target selection which proved to be far more significant than was realized at the time. One was a partial switch from rail targets to road targets, the intent being to reduce the motor transport capacity on which the Germans were increasingly forced to rely as a supplement to their damaged railroad network. Along with this change, and partly connected with it, more of the air effort was shifted from the interdiction belt north of Rome to an area closer to the enemy front lines. This was where the fighter-bombers could operate more effectively against road targets, and where destruction of supplies might create more immediate shortages in the German front line units while they were trying to defend against the Allied ground attack.

As a result of these changes, M.A.A.F. succeeded in crippling the enemy's means of road transport in the critical forward area through

the destruction of bridges, roads, and vehicles, and by creating road blocks and choke points in places where rerouting was difficult or impossible. Though the enemy's road mobility was severely impaired by these attacks, they did not produce the desired effect on the supply situation of the German front line troops whose stocks of ammunition and even fuel, though depleted, never fell to a critical level.

The attacks did, however, achieve another result which, by the enemy's own testimony, contributed more than any other single factor to his defeat. The reduction and occasional paralysis of his freedom of movement in the combat area made it increasingly difficult for the field commanders to strengthen weak positions or seal off an Allied breakthrough by rushing reinforcements quickly from one sector of the thinly held line to another. Since the Germans had no tactical reserves behind the front, there was no other way of shoring up a threatened position. The strategic reserve divisions held in the north were not intended for this use, and when they were finally released to the front their movement was so delayed and hampered by Allied air attacks that they arrived too late and too disorganized to stem the tide. Tactical mobility was essential to the German combat tactics, and its denial dealt them a crucial blow.

The developments in the Italian campaign suggest some questions that may have an important bearing on future interdiction doctrine: Why did supply denial prove to be an unattainable objective? Should mobility denial have been chosen all along as the preferred objective? And would the answers apply only in the circumstances prevailing in the Italian theater, or might they be valid in different types of war as well?

First, there should be no doubt that the STRANGLE and DIADEM campaigns did indeed fail to achieve supply denial. This is apparent from the Quartermaster records and War Diaries of the German armies.* The stocks of such critical items as ammunition and automotive fuel actually increased during STRANGLE. They declined later on, when German army consumption rose steeply during the Allied ground offensive, but

*See *Section IV, The Effects on German Supply;* also Appendix A.

not to the point of creating overall shortages in the front line units. There were temporary spot shortages of certain items caused by distribution difficulties that inevitably occur during intensive combat and were of course aggravated by the effects of the Allied interdiction campaign. The German supply officers were confronted with a staggering task in trying to maintain the necessary flow of supplies under the conditions created by Allied air action, but seem to have succeeded on the whole in getting essential supplies to the troops on time. Their feat earned them high praise from the field commanders, some of whom remarked on the fact that even under the worst conditions of the retreat their troops never suffered from critical supply shortages.

Why it was impossible to achieve supply denial can be explained by a combination of factors, most of them inherent in the tactical situation confronting the Allies and therefore beyond their control. During STRANGLE the major factors were the redundant capacity of the enemy's transport network, especially in the north where the interdiction belt had been placed; German ingenuity in effecting quick repairs, finding alternative routes, and improvising substitutes; the frugal living standards and stringent conservation measures imposed on the German armies, coupled with their low consumption rates during the two months while there was no ground action on the front; the intermittent periods of bad weather when Allied air was grounded so that the Germans were able to make repairs and move up supplies; and the lack of an adequate night bomber capability in M.A.A.F., which made the nighttime relatively safe for repair-work and the movement of supplies.

The Germans were therefore able, during STRANGLE, to maintain and even increase a supply cushion in the forward area that made them virtually independent of resupply from the rear for the length of time an intensive ground battle could be expected to last. This was why the interdiction attacks during DIADEM, though more effective in isolating the forward area, did not produce supply shortages in time to affect the outcome of the battle. That outcome, already foreordained, was determined some three weeks after the offensive began, when the CAESAR Line was breached. Although the Germans continued to fight stubborn rearguard actions thereafter, they were in full retreat and

to all intents and purposes the battle was over. But if it had not been won by then it would have been over in any case, for the Allied Commander-in-Chief, General Alexander, had planned to halt the action at the end of May and to wait until he could rest and regroup his armies for a new assault. The German supply cushion had thus proved sufficient to last for the duration of the ground offensive.

With the benefit of hindsight, one might ask why M.A.A.F. did not seem to have realized that conditions in the Italian theater foreclosed any hope of achieving supply denial. STRANGLE was almost over before M.A.A.F. gave up the belief that air interdiction alone could force a withdrawal of the German armies from central Italy. And even during DIADEM, M.A.A.F. continued to cling to the scaled-down version of their original objective, in the expectation that they could at least stop the additional supplies the Germans would need during the ground battle. A possible explanation may be that the Allied planners lacked an adequate understanding of the German supply system, and--more importantly--may not have appreciated how crucial such an understanding was for their task. Interdiction still was a relatively novel mission and there was a good deal of improvisation as the campaign went along. Fortunately for its success, the tactical air commanders and their pilots seem to have improvised in the right direction.

Now that the results of the campaign are available to us, it is clear that mobility denial and not supply denial should have been the objective from the beginning. But would it have made all that difference, since M.A.A.F. did succeed, even while aiming at the enemy's supply system, in paralyzing his tactical mobility as well? It is true that many of the targets would have been the same, especially during the latter phase of the interdiction campaign when M.A.A.F. began to attack the road system which was needed for the movement of troops as well as supplies. It is also true that supply denial was the overriding but not the sole objective, as witnessed by the fighter-bomber attacks on road traffic and on the German reserve divisions during their march to the front. But it stands to reason that the campaign would have been more effective if mobility denial had been

pursued as a single-minded objective, instead of being mainly the incidental result of attacks planned for a different purpose.

How such a campaign would have differed cannot be indicated in detail, for this would have depended not only on the objective but also on operational constraints and on the tactical ground situation. The Allied ground commanders, for instance, might have vetoed the destruction of certain bridges or road communications that their own troops would wish to use in pursuit of a retreating enemy. Weather conditions or the characteristics of available aircraft would influence the choice of target areas and of specific targets. But there are certain basic features that would have been different if the Italian interdiction campaign had been specifically designed to assist the Allied ground offensive by impairing the tactical mobility of the German armies.

In the first place, the time dimension would have had to be given more consideration in the planning of the campaign. The effects of mobility denial are time-limited. During the two months while STRANGLE was going on, the Germans were able to devise ways of restoring essential portions of their damaged communications network and of reducing their dependence upon it. A mobility denial campaign must be timed so as to deprive the enemy of mobility just when he needs it most, and without giving him time to restore it. One factor that accounted for the great success of the bridge-busting campaign in France during the Normandy invasion was that the attacks on the Seine and Loire bridges were delayed for security reasons until just before D-day, when a maximum effort was launched against them. The perfect timing of that campaign made it impossible for the Germans to repair the bridges or to improvise alternative routes in time to get desperately needed reinforcements to the front before the Allied beachhead had been made secure. In the Italian campaign, too, the results would have been more devastating for the enemy if STRANGLE had been compressed into a shorter period, timed to achieve the maximum effect just before the ground offensive was launched.

Another, and perhaps the most important, difference would have been in the selection of targets. During most of STRANGLE, the main

weight of the interdiction effort was directed against rail targets in the area north of Rome, which made supply movement more difficult but had little effect on the enemy's tactical mobility. The attacks on road targets, begun when the enemy was forced to supplement his damaged rail system by resorting to road movement, were also designed to head off supplies reaching the combat area from the north. They would have been more effective in interfering with enemy redeployments if they had been concentrated more in his forward area where most of the essential troop movements took place. Some of the targets attacked during DIADEM would have been the same, regardless of the objective; but if the avowed purpose had been to deny tactical mobility to the German armies, more effort would have been devoted to lateral communication links along the enemy's front than to his communications with the rear. Lateral troop movements were essential to the German defense tactics, and they depended on the road network since there were no lateral rail lines in the vicinity of the front. M.A.A.F.'s target choice was logical from the standpoint of trying to stop supplies from coming into central Italy. But in order to maximize the impact on the enemy's tactical mobility, more effort should have been devoted to road targets than to rail targets; to the combat zone near the FEBA, rather than to the area further north; and to lateral communication links behind the front in preference to roads leading to the rear.

Apart from the differences in timing and target selection, an interdiction campaign specifically aimed at mobility denial would have required close coordination between the air and ground forces in the overall planning of the combined effort. But no such effort was envisaged by M.A.A.F. when STRANGLE was launched. Since it was originally conceived as an independent air operation, it did not require coordination with the plans for the ground offensive which it was to have made unnecessary.

By the time the need for a combined air and ground assault was recognized, two weeks before the start of DIADEM, the plans for the ground offensive had already been worked out in detail and it would have been too late to make major changes in them. M.A.A.F. had more

flexibility in adjusting their plans for the air effort, but there is no indication that they conceived their task during DIADEM as being substantially different from what it had been during STRANGLE (see p. 61). What coordination there was between the air and ground effort was therefore mainly at the operational level, in connection with the close air support of the friendly ground forces to which M.A.A.F. diverted some of their forces during the DIADEM phase. But there was no truly joint planning on an overall basis.

If there had been, the interdiction campaign would have been designed from the start with the needs of the ground offensive in mind, while the ground operations would have been planned so as to provide lucrative targets for air attack and to take advantage of the fleeting effects of interdiction upon the enemy's tactical mobility. Joint planning would have had the additional benefit of encouraging air and ground commanders to make more use of the specialized knowledge the other service possessed. The Allied Army intelligence officers probably could have helped their M.A.A.F. colleagues in the design of the interdiction campaign since they were undoubtedly better informed about the supply system of the German armies and their combat tactics, such as their need to move troops quickly from one sector of the front to another. Similarly, the air intelligence officers undoubtedly had reconnaissance information that could have prevented their Army colleagues from overestimating the strength and availability of the opposing forces, as they did at Anzio and on other occasions.

The impairment of the enemy's tactical mobility was not the only incidental result of the interdiction campaign, though it was undoubtedly the most important. But there was another by-product of the attacks on the German supply system: the general disruption of the enemy's normal operating procedures disorganized the essential support services which were necessary to maintain the combat efficiency of the front line troops. The cumulative effect of the difficulties, large and small, created as a result of the widespread damage inflicted on the enemy's rear is impossible to assess in concrete terms, but we know that the German commanders considered it a factor in the decline of the fighting effectiveness of their units. As such, it undoubtedly made a

valuable contribution to the success of the friendly ground forces. It is one effect, however, that--unlike mobility denial--cannot be deliberately planned for unless indiscriminate destruction is the goal.

All that has been said so far applies only to the specific conditions that prevailed in the Italian theater. That supply denial was unsuccessful under these conditions does not mean that it would also be the wrong objective in a war in which the geography, the enemy's supply system, and his consumption requirements are different. In the British Desert Campaign against Rommel's forces in 1941-1942, for instance, both sides were completely dependent on supply convoys bringing into the theater the fuel, spare parts, and replacements that were essential for tank warfare in the desert. The Germans had no alternative to the vulnerable sea route, and no opportunity to build up a supply cushion against a well-timed offensive. In these circumstances, supply denial was the ideal objective for interdiction and was so recognized by Air Marshal Tedder, whose successful campaign against Rommel's supply lines suffered only from the size and short range of his minuscule Desert Air Force.

A similar combination of circumstances could recur in the future: a long and vulnerable supply line, lack of alternative routes, and high consumption requirements for specialized items for which no substitutes can be obtained locally. If such conditions should prevail, supply denial would again be a proper objective for an interdiction campaign.

As for tactical mobility, which proved to be the Achilles' heel of the German armies, it is more difficult to extrapolate from the experience of the Italian campaign since there were certain factors, some of them unique, that made the Germans especially vulnerable in this respect. Among them was Hitler's order that the armies must hold a static line; the shortage of troops and reserves that required them to move reinforcements quickly back and forth along the front; the fact that the heavier German divisions were roadbound, with little or no cross-country capability; and the mountainous terrain with many natural bottlenecks and few rerouting possibilities.

This precise combination of factors is not likely to be encountered again, though some of them may recur. Whether they do or not,

mobility is important in almost any type of ground warfare. But we must recognize that styles and means of warfare will be different from what they were in Italy and that the kind of mobility we may wish to deny to an enemy may also be of a very different sort.

In Korea and Vietnam we faced an enemy who was definitely not roadbound, whose consumption needs were frugal beyond anything the Germans ever dreamed of, to whom the holding of territory meant very little, and who could select the time and occasion when he was willing to fight. To deny mobility to such an enemy is a different and more difficult task than confronted the Allies in the Italian campaign. It would be still different in a war between modern, highly mechanized armies, fought under the ever-present threat of nuclear weapons. Whether mobility denial would be the right objective for interdiction in these or other wars, and how such a campaign might be conducted, are subjects beyond the scope of this study. They are being addressed in other studies conducted as part of Rand's program of tactical air studies.

As a concluding note to the Italian air campaign, it should be mentioned that although this study was solely concerned with interdiction, airpower made other valuable contributions to the success of the Allied ground offensive. The achievement of complete air supremacy, the close support of the friendly ground forces, surveillance of the enemy armies through constant air reconnaissance, the accurate artillery fire made possible by aerial spotting--all were important factors in the Allied victory. But the lion's share of the credit belongs to interdiction, for there is no doubt that STRANGLE (and its continuation in DIADEM) was an unqualified success by any measure other than the one set for it by its planners. It did not achieve supply denial, which had been its objective, but it contributed immeasurably to the defeat of the German armies by denying them the tactical mobility which was essential to them.

If there is one lesson to be drawn from this case study, it is that the term "interdiction" is not limited to a single kind of air campaign. It covers a variety of missions that may serve different objectives, depending on the tactical situation prevailing in the

theater. Hence there is no such thing as a universally applicable interdiction doctrine. An interdiction campaign must be closely geared to the purpose of the operation and the conditions under which it is waged.

ACKNOWLEDGMENTS

I wish to thank Mr. Robert E. Schmaltz of the Office of the Assistant Chief of Staff, Studies and Analysis, Hq, United States Air Force, for giving me access to his source material on Operation STRANGLE and allowing me to benefit from his own pioneering studies of this and other interdiction campaigns.

I owe much to my Rand colleague, Edmund Dews. The stimulating dialogues with him throughout the progress of this work were invaluable in helping me to clarify my thoughts on critical issues.

An earlier version of the study was reviewed by another Rand colleague, Alfred Goldberg, to whom I am indebted for his knowledgeable and helpful comments on a number of important points.

CONTENTS

LIST OF ABBREVIATIONS

In some footnotes abbreviated source references were used. They are listed below in alphabetical order. A full citation of these and other sources will be found in Appendix B.

AAF History	The history of *The Army Air Forces in World War II*, prepared by the USAF Historical Division.
Army Diary	The daily war diary of the German Tenth Army.
Corps Diary	The daily war diary of the German XIV Panzer Corps.
M.A.A.F. Report	A 7-volume report, with many enclosures, entitled *Mediterranean Allied Air Forces Operations in Support of DIADEM*. Prepared by the M.A.A.F. historian from the operations summaries kept during STRANGLE and DIADEM.
MS (followed by manuscript number)	Manuscripts prepared by German officers involved in World War II campaigns for the U.S. Army Chief of Military History after the war.
Narrative	A condensation of the narrative portions of the 7-volume M.A.A.F. Report.
Shepperd	G. A. Shepperd, *The Italian Campaign 1943-1945*. With an Introduction by Field-Marshal Lord Harding, Chief of Staff to General Alexander during the campaign.
Slessor	Marshal of the Royal Air Force Sir John Slessor, *The Central Blue*. His memoirs.
Tedder	Marshal of the Royal Air Force Lord Tedder, *With Prejudice*. His memoirs.

I. INTRODUCTION*

Of the three Air Force missions usually included under the heading of tactical air operations--Counter Air, Close Air Support, and Air Interdiction--the last is the least well defined. The term "interdiction" first came into general use during the Italian campaigns in World War II. The basic concept, however, goes back to World War I when the Royal Flying Corps conceived the idea of using the new instrument of airpower to weaken the opposing ground forces through attacks on their rear communications. This new mission came to be referred to grandiloquently as "isolation of the battlefield."

The unfortunate tendency, deplored by more far-seeing airmen, to promise more than airpower could deliver has been one of the difficulties in arriving at a realistic definition of interdiction. Another has been the continuing disagreement between Air Force and Army officers--those charged with the mission and those for whose benefit it is conducted--as to the purpose and utility of this particular use of tactical airpower.

To add to the confusion, in the latter part of World War II and since then, the term interdiction has often been given a broader connotation, and the definition further blurred in the process, by applying it to missions that go beyond the original, tactical objective of interdiction and may include almost any type of air attack on targets in the enemy's rear. The current edition of Air Force Manual AFM 2-1 on Tactical Air Operations refers to air interdiction as follows:

> The air interdiction program is conducted to destroy, neutralize or delay the enemy's military potential before it can be brought to bear effectively against friendly forces and to restrict the mobility of enemy forces by disrupting their lines of communication.**

---

*The following note on the definition problem was written in November 1969 when the Rand program of tactical air interdiction studies was in the design stage. The case study of Operation STRANGLE is part of this broader project.

**Air Force Manual AFM 2-1, Aerospace Operational Doctrine, *Tactical Operations - Counter Air, Close Air Support, and Air Interdiction*, Department of the Air Force, 2 May 1969.

This definition, though intended for a *tactical* mission, could be applied to strategic air attacks on "the enemy's military potential" as well. In fact, it has been so applied since the strategic bombing offensive in World War II is sometimes referred to as "strategic interdiction," presumably because one of its purposes was to disrupt the production and movement of war material that eventually would have reached the enemy's combat forces.

Whether strategic bombing properly comes under the heading of interdiction is a matter of semantics. Being directed at the sources of the enemy's military and economic strength, however, it clearly differs from the kind of interdiction that seeks to produce a direct and more immediate effect on his deployed forces. If the same term must be used for both, we therefore need to distinguish between "strategic" and "tactical" air interdiction in the sense in which these words have still retained their meaning. The purpose of strategic interdiction would be to achieve a *general* reduction in the enemy's ability to supply and move his combat forces. Tactical interdiction, on the other hand, is directed against the supplies and mobility of *specific* enemy forces, deployed in a *specific* combat area, prior to or during an engagement with friendly ground forces.

This distinction between the objectives of the two types of interdiction will serve as a working definition to indicate what this study of tactical air interdiction is, and is not, intended to cover.* It does not describe the mission, beyond the fact that it is undertaken to further a ground force objective. An operationally more meaningful description of the task will emerge as the study proceeds.

One problem in defining a mission on the basis of its objective is that military operations are often undertaken for multiple objectives. Lord Tedder's controversial plan of March 1944 for bombing German railway communications in Western Europe is a good example. The plan served the important tactical objective of isolating the

---

*For a similar but independently developed approach to the definition problem, see: Edmund Dews, *A Note on Tactical Versus Strategic Air Interdiction*, The Rand Corporation, RM-6239-PR, April 1970.

invasion area in preparation for the Normandy landing so as to neutralize the German advantage in being able to operate from interior lines of communication. At the same time, the bombing was conceived as a "massive and sustained strategic offensive against key points in the railway system and against the railway repair organization which was ultimately designed not merely to isolate the Normandy area, or even to isolate France from Germany, but to dislocate the entire railway system of German Europe."* In that sense, its objective was strategic. No such problem of dual objectives arose in the case of the pre-D-day attacks on the Seine bridges which were an example of tactical air interdiction, pure and simple.

Another approach to the definition problem has been to distinguish between strategic and tactical interdiction on the basis of target location. "Deep" penetrations against remote targets in the enemy's rear would be classed as "strategic," while "close-in" attacks on targets in the immediate vicinity of the battlefield would be considered "tactical." This distinction had some validity in World War II when the normal mission of the strategic air forces--which alone had the range to carry out deep penetrations--was to attack the enemy's war-making capacity and not his deployed forces or their immediate supply lines. But this was not always the case. Even in World War II the strategic air forces were sometimes used or, in the opinion of some of their commanders, misused, in a tactical role, to attack targets of direct concern to the ground forces.

One notable instance occurred during the air interdiction campaign against the German forces in Italy in the spring of 1944. The targets for this campaign (Operation STRANGLE) were split between the tactical and strategic components of the Mediterranean Allied Air Forces (M.A.A.F). The more remote targets in northern Italy were assigned to the longer-range bombers of the strategic air forces, while the tactical component of MAAF concentrated on the closer targets south of the Pisa-Rimini Line. The attacks by both forces served the same tactical

---

*Sir Charles Webster and Noble Frankland, *The Strategic Air Offensive Against Germany 1939-1945*, HMSO, London 1961, Vol. III, p. 31.

objective of disrupting the flow of supplies and reinforcements to the German armies prior to the Allied ground assault on their positions in the GUSTAV Line (Operation DIADEM).

Similarly, in the earlier campaigns in the Middle East, the tactical objective of denying supplies to Rommel's Africa Corps was partly achieved through deep interdiction attacks on ports and rail centers in southern Italy and Sicily through which men and materiel for North Africa had to pass, and partly through close-in attacks on the debarkation ports and supply dumps in the theater itself. The location of the targets for these tactical interdiction attacks was therefore without significance, except to influence the choice of aircraft available to different organizational units. Even this factor is rarely relevant today when tactical aircraft can perform deep penetrations that were the exclusive province of the strategic air forces in World War II.

Therefore, despite the problem of multiple objectives, it would seem that the principal objective of the mission is a more meaningful basis for distinguishing between tactical and strategic air interdiction than the location of the targets or the kind of organization that is carrying out the attacks.

If the objective of tactical air interdiction is to influence an impending or on-going ground battle, a meaningful concept of the air mission must be related to the specific conditions in which the ground action takes place. Such factors as the structure and equipment of the enemy armies, their strategy and combat tactics, their supply system, the geography of the theater as a whole and the terrain within and near the battle zone--all will affect the opportunities for tactical interdiction and how the mission should be performed. The tactics of the friendly ground forces, and whether they understand the use of airpower sufficiently to take advantage of the fleeting opportunities that interdiction may create for them, may be even more important in circumscribing that role.

These tactical conditions vary greatly in different wars and in different theaters. In the World War II campaign against Italy, the enemy's posture seemed almost ideally suited for a successful air interdiction campaign. The heavily equipped German armies had a high

consumption rate and were forced to defend static positions at the end of a long and vulnerable supply line. The rugged terrain behind their front line positions channeled the lateral movement of troop reinforcements to a few mountain roads that could be disrupted by destroying bridges and defiles. Contrast this with the situation in Korea or Vietnam. In both cases we faced an elusive, lightly equipped enemy who was not roadbound and whose frugal consumption needs could be met by a primitive supply system that was difficult or impossible to disrupt through air attack. Moreover, the availability of sanctuaries rendered portions of his supply line immune to attack.

It is clear, therefore, that our task in trying to arrive at a concept of tactical air interdiction cannot be confined to the problems that are usually the major concern of those who execute the mission. Such questions as whether the friendly air forces have air superiority, whether they have an adequate sortie capability, their ability to acquire and destroy targets, have an important bearing on the effectiveness of airpower in the narrow sense. But they do not determine the effectiveness of tactical air interdiction in the broader sense, which can be assessed only in its impact on the ground action. And since that impact, in turn, depends not on the air effort alone but also on the tactical conditions in which the ground action takes place, any meaningful concept of air interdiction must differentiate between the ground situations in which the air action is conducted.

A definition of the mission that ignores the difference in tactical conditions and is equally applicable to a mechanized war in Europe and to a checkerboard war in Vietnam would have to be so general as to be of no value for our purpose. Instead of working with a single concept of tactical air interdiction, the planners therefore may have to formulate several concepts, each relating to a specific set of tactical conditions that are representative of the ground situations likely to be encountered in different kinds of war.

The current USAF doctrine of tactical air interdiction originated and was formulated in World War II, and specifically in the war with Germany. Hence it is based, at least implicitly, on tactical conditions

which, on the whole, provided opportunities for successful application of the concept. This is not surprising, for as a rule doctrine is shaped by favorable and not by unfavorable experience.

In seeking to trace the evolution of the concept in World War II, we will therefore be concerned with situations that generally favored tactical air interdiction. This should not lead us to assume that this particular concept is equally applicable to tactical situations in which the ingredients that made for its success in certain World War II campaigns are absent. All we can do here is to identify the ingredients that were necessary for its success. How their absence would change the concept of interdiction will require analysis of the historical experience gained under less favorable conditions, such as those that prevailed in Korea and Vietnam.

II. OPERATION "STRANGLE"--THE SETTING (Italy, Spring 1944)

Much of the current thinking on air interdiction dates back to an event whose significance may have been forgotten or become distorted in our memories. The event was one of the outstanding air campaigns of World War II, called Operation STRANGLE. Its purpose was to interdict the flow of supplies to the German armies in Italy through the systematic destruction of the enemy's rail and road network.

Operation STRANGLE is usually dated from 19 March 1944 when the directive for its inception was issued. It ended, strictly speaking, two months later, on 11 May, the day the Allies launched a massive ground offensive against the German lines. The interdiction effort was kept up beyond that day and continued, with some modifications, throughout the period of the ensuing ground battles, but its continuation during that phase is usually referred to under the code name for the ground offensive, DIADEM.*

The combined air and ground effort enabled the Allies to break through the heavily fortified German GUSTAV Line, capture Rome, and drive the shattered enemy armies back to northern Italy where they were finally able to stabilize on a new line. The interdiction campaign, which was unprecedented at the time in its scale, duration, and singleness of purpose, is credited with having played a vital and possibly decisive part in the success of the Allied offensive. In the Headquarters of the Mediterranean Allied Air Forces, STRANGLE was hailed as a triumph of tactical air operations.

But this is not the reason why STRANGLE was chosen here as a case study of air interdiction. Whatever it may have contributed militarily, or by demonstrating the potential of airpower to sceptical critics,

---

*Since STRANGLE shaded into DIADEM, its identity as a differently conceived operation has become blurred in official accounts which, after the event, referred to STRANGLE as the "preparatory phase" of a continuing interdiction campaign. But the air attacks during STRANGLE and DIADEM only appear to be similar; in fact, important conceptual differences were involved which will help us to clarify the state of interdiction doctrine at the time.

its long-term significance lies in the effect it had in shaping U.S. tactical air doctrine for the future.*

Operation STRANGLE is not as widely known as the successful interdiction campaign that was launched from England in support of the Normandy invasion (OVERLORD). The two air campaigns partially overlapped, but world attention was understandably centered on the one in the West where the riskiest enterprise the Allies had yet attempted was taking its dramatic course. The contribution of airpower to the success of OVERLORD is therefore better remembered, and more often mentioned by historians, than the air campaign in the Italian theater which was overshadowed by the more spectacular events in Normandy.

Yet many of the ideas that were applied in the interdiction of the Normandy battlefield had been developed in the Mediterranean campaigns and had received their first full-scale test in Operation STRANGLE. In effect, STRANGLE served as a dress rehearsal for the use of airpower in OVERLORD and was so recognized in both theaters. The air commander in Italy, General Eaker, kept in almost daily contact with General Spaatz in England, in addition to sending frequent reports to General Arnold in Washington. On the British side, General Eaker's Deputy, Sir John Slessor, took care to keep the RAF Chief of Air Staff informed of developments in the Italian campaign.** Moreover, senior air commanders involved in the preparations for OVERLORD made personal visits to the Italian theater while STRANGLE was in progress to collect first-hand impressions.

The meticulously detailed planning for OVERLORD was of course far advanced by the time STRANGLE began (in March 1944). But there were changes and modifications in these plans, and especially in the air

---

*I was not the first to be interested in this aspect of STRANGLE. It has been used in earlier studies of interdiction doctrine, e.g., *The Uncertainty of Predicting Results of an Interdiction Campaign - Saber Measures (ALPHA)*, USAF, Assistant Chief of Staff, Studies and Analysis, December 1969; and *The Practice of Air Interdiction: Our Experience in World War II*, AFGOA Paper 69-1, Hq, USAF, Operations Analysis, May 1969.

**One of his reports, written on 16 April in the middle of STRANGLE, is summarized below, pp. 43-44. It is an outstanding document that could not have failed to influence the OVERLORD planners.

plans, throughout the months leading up the invasion. The successful bridge-busting campaign against the Seine and Loire bridges was a late addition advocated by Generals Spaatz and Brereton on the basis of the experience during the Italian campaign.*

This is not to suggest that the interdiction campaign in OVERLORD was a replica of STRANGLE. Not only was the tactical situation entirely different in the two theaters, but there were important differences in the personalities and experience of the air commanders involved. Yet the distinction lay mainly in the way interdiction doctrine was applied and not in the doctrine itself. The basic doctrine was the same in both cases. Essentially, it was the doctrine of tactical air interdiction that had been generated and perfected in the Mediterranean campaigns and had become largely solidified as the result of what was regarded as its highly successful application in STRANGLE. As the M.A.A.F. historian put it:

> The Mediterranean theater has been a crucible for air strategy and tactics since El Alamein. Each succeeding battle in the long march across Africa through Tunis to Pantellaria, Sicily and Italy had witnessed further refinements in the art of assisting ground advance by air attack. In the battle for Rome this art produced its masterpiece to date and established as firm doctrine a number of principles of aerial warfare which had only been partially enunciated and tested before.**

It is the Mediterranean campaigns, therefore, to which one must turn in tracing the evolution of tactical air doctrine in World War II. The concept of interdiction--or "isolation of the battlefield," as it was first called by optimistic airmen--goes back to World War I. But it had to be reinvented, for the lessons learned in the earlier war had been forgotten or misread by all but a few.

One of the few was Air Marshal Tedder, who used his minuscule air force with telling effect to interdict Rommel's supply lines in the Desert Campaign of 1941-1942. It is true that many improvements and

---

*AAF History, Vol. III, p. 157.

**M.A.A.F. Report, Vol. VII, p. 2.

refinements were added in subsequent campaigns, although the path of evolution was by no means as smooth or straight as the M.A.A.F. historian seemed to imply. The use of airpower in North Africa, for instance, especially in the beginning, was regarded by USAAF officers as a wasteful and often incorrect use of their resources.*

Nevertheless, the concept of interdiction became more and more firmly established in the years following Tedder's first successful application until it was ready for its acid test in Operation STRANGLE. Having successfully met this test, at least in the opinion of its sponsors, the interdiction strategy used in that campaign became enshrined as Air Force doctrine.

The Air Situation

If Operation STRANGLE was to be the test, at least it did not suffer from lack of adequate air strength. The situation in Italy on 19 March 1944, when the interdiction campaign was launched, was a far cry from the conditions in which Air Marshal Tedder had to operate in the Middle East three years earlier. At that time he could muster a maximum of 200 combat aircraft which had to be used not only for interdiction, but to fight a battle for air superiority against a still formidable Luftwaffe, to provide air cover for ground and naval operations, and to supply airpower for use in adjoining theaters.**

By contrast, the Mediterranean Allied Air Forces under General Eaker*** had around 4000 combat aircraft in operational units. More

---

*See the so-called "Kuter Report," an interview with Brigadier General Laurence S. Kuter, Deputy Commander, Tactical Air Force, Tunisian Campaign. A manuscript, dated May 5, 1943.

**Tedder, p. 120.

***In January 1944 an American officer, Lieutenant General Ira C. Eaker, replaced Air Chief Marshal Sir Arthur Tedder as the Allied Air Commander-in-Chief, Mediterranean. His Deputy was Air Marshal Sir John Slessor. The combined Anglo-American air forces--renamed the Mediterranean Allied Air Forces--were divided along functional lines into a Strategic (MASAF), Tactical (MATAF), and Coastal (MACAF) component, each comprising USAAF and RAF units. General Eaker reported to the new theater commander, General Sir Henry Maitland ("Jumbo") Wilson, who had replaced General Eisenhower as Supreme Allied Commander,

than half, including the valuable fighter-bombers, were in the Tactical and Coastal components (MATAF and MACAF). These were available almost in their entirety for the interdiction campaign since there was little ground fighting during STRANGLE and only a relatively small effort was required to maintain continuing air superiority. The Strategic component (MASAF) which made up the rest of the combat force also contributed to the interdiction attacks when not required for higher priority missions against Germany itself.* With such a large force at his disposal, General Eaker was able to mount an average of 1352 effective sorties per day during the three month period from the beginning of STRANGLE to the end of DIADEM. The daily average of bombs dropped was 843 tons.**

Another important advantage in the interdiction campaign was that the Luftwaffe no longer offered a serious challenge to Allied airpower in the Italian theater. On the day after DIADEM was launched, "... a generous estimate by the M.A.A.F. Intelligence Staff would have given the German air force 250 bombers and fighter-bombers, 200 fighters, and 75 reconnaissance aircraft, located on bases widely scattered in southern France and northern Italy."*** The only effective opposition the Allied air forces encountered came from German flak, which was responsible for most of the aircraft losses sustained during the campaign.

In fact, the disparity in the air strength of the two sides was even greater than the number of aircraft would indicate, for there was a difference in the quality of the crews as well. The German pilots no longer were the highly trained, dedicated professionals who had fought in the Battle of Britain. Outnumbered and outclassed, their training curtailed by the fuel shortage, disillusioned with Göring

---

Mediterranean (SACMED). The reshuffling of the command structure in the Mediterranean was occasioned by the departure of several senior commanders for England, where important assignments in the OVERLORD invasion awaited them.

*See footnote on p. 18.

**These are averages for the entire period, including many days when bad flying weather forced all or a portion of the force to stand down. The actual effort reached as high as 3000 sorties on days when conditions were favorable. See Narrative, p. 201.

***M.A.A.F. Report, VII, Tab "FF."

and his cronies in the Luftwaffe high command, their combat performance had declined sharply.*

The war diaries of the German armies during the Italian campaign record almost daily complaints about the absence of air support. One army commander reported to Field-Marshal Kesselring that his hard-fighting soldiers were disgusted when they finally saw a few friendly aircraft overhead and had to watch them turn tail and run, instead of challenging the Allied fighters who were pounding the German positions.** Another ground commander noted that on days when the Luftwaffe pleaded bad weather as its excuse for standing down, the Allies were flying hundreds of sorties without seeming to be handicapped by the weather.*** The almost total lack of air reconnaissance was another source of constant complaint; the German commanders had to rely on prisoner interrogation for information on Allied troop dispositions. As one diary entry sadly acknowledged, the Allied air forces enjoyed *Alleinherrschaft*; they were the sole rulers of the skies. In the Italian theater the M.A.A.F. had achieved not just air superiority but air supremacy.

The Ground Situation

In an earlier section the point was made that the opportunities for air interdiction, and its results, depend not only on the air situation but on the tactical conditions in which the opposing ground armies find themselves. A brief review of the fighting that led up to the decision to launch STRANGLE will help to set the stage.

The struggle for the Italian mainland began in early September 1943 when the Allies crossed the Straits of Messina after the conquest of Sicily. A hard battle was fought at Salerno where the Allies had

---

*The deterioration of Luftwaffe personnel in the later stages of the war is cited in a number of post-war accounts by former Luftwaffe officers. See, for example, Adolf Galland, *The First and the Last*, Henry Holt and Company, New York, 1954, pp. 215, 255, 315, and *Passim*.

**Army Diary, Encl., 4/16.

***Corps Diary, 4/9.

established a precarious beachhead, but eventually they were able to secure the port and to capture Naples as well. Then the two armies comprising General Alexander's Fifteenth Army Group--General Mark Clark's Fifth Army in the West and General Montgomery's Eighth Army in the East*--began to fight their way slowly and painfully up the Italian boot. The Germans, though handicapped by the overthrow of Mussolini and the defection of their Italian ally, conducted a skillful withdrawal and managed to hold the Allied advance to a snail's pace. It ground to a complete halt in the middle of January 1944, after four months of costly fighting, when the Allies were stopped by the heavily fortified GUSTAV Line which the Germans had built in the rugged terrain of central Italy. Its linchpin was the formidable position of Monte Cassino.

In order to outflank this obstacle, a major amphibious operation (SHINGLE) was launched on 22 January 1944 against the port of Anzio, further up the coast on the road toward Rome. A simultaneous diversionary attack was made on the GUSTAV Line itself, including the first of several futile attempts to storm Monte Cassino. Both operations were a disappointment. The costly effort to break through the German position on the main front had failed. Of the landing at Anzio, Sir Winston Churchill was to remark that he "had hoped we were hurling a wildcat onto the shore, but all we had got was a stranded whale."** The whale, in the shape of an Allied army corps that eventually swelled to 125,000 men, remained stranded on the beachhead for four whole months, from January until the DIADEM offensive in May 1944.

Another attempt to break the stalemate on the GUSTAV Line was made in the middle of February, in what became known as the second battle for Cassino. It was preceded by the controversial bombing of the Benedictine monastery on top of the mountain, one of the great shrines of Christendom. The air attack succeeded in reducing Monte Cassino Abbey to a pile of rubble but the somewhat belated follow-up attack by General Freyberg's New Zealanders was once again beaten back by the resolute defense.

---

*Montgomery left for his new assignment in England at the turn of the year and was replaced by Sir Oliver Leese.

**Churchill, *Closing the Ring*, p. 488.

A third major effort to storm Monte Cassino was made on 15 March, following one of the heaviest air attacks of the campaign. The bombardment may have helped the defenders more than the attackers, whose tanks were slowed or stopped by the bomb craters while the defenders were able to take cover in the masonry rubble created by the destruction of buildings in the town of Cassino. After a few days of fruitless assault, the Allies were again forced to give up. For three months, the Germans had thrown back all attempts to capture this vital position.

The opposing ground forces were too evenly matched for either side to be able to break the deadlock that had developed on the Italian front.

The Allied Army Group under General Alexander numbered 21 divisions at the time, of which 7 plus divisions were immobilized in the Anzio beachhead. The rest were ranged along the GUSTAV Line, with a heavy concentration of force in General Mark Clark's Fifth Army, which faced the southern sector of the Line. It was a force of many nationalities, containing U.S., British, Canadian, New Zealand, Indian, French (chiefly North African), and Polish divisions. Among its assets were its superior mobility, a wealth of artillery, and lavish ammunition allowances which were the envy of the German commanders. Most important of all, the vast Allied airpower exposed the enemy ground forces to constant attack while the Luftwaffe was unable to interfere with our own forces.

The German Commander-in-Chief, Field-Marshal Kesselring, had 19 combat divisions under his control. Another 4 divisions were in northern Italy in a separate Army Group commanded by General von Zangen. They were second-line divisions, used mainly for occupation duties, and played no part in the battles in central Italy.

Kesselring's Army Group "C" was composed of the Tenth Army under General von Vietinghoff, who defended the GUSTAV Line with approximately 10 divisions, and the Fourteenth Army--at the time commanded by General von Mackensen--which ringed the Anzio beachhead. One or two divisions were in Army Group reserve against a possible Allied landing further up the coast.*

---

*The number of divisions in the two German armies varied as units, or parts of units, were shifted from one front to the other. One division held in reserve--the Herman Göring Panzer S.S. Division--could be released to Kesselring only with permission from Hitler's OKW.

The Germans were handicapped because they had to conserve ammunition and fuel and could not get sufficient replacements for the troop casualties incurred during periods of heavy fighting. Possibly their greatest disadvantage, however, aside from Allied air supremacy, was Hitler's order, strictly enforced by a subservient Kesselring, that they must defend every inch of ground. This made it impossible for such excellent tacticians as the commander of the XIV Panzer Corps, General von Senger und Etterlin, to carry out a mobile defense by trading ground for military advantage.

On the other hand, the Germans were aided by the difficult terrain of central Italy, which they had used with great skill to develop a naturally strong defensive position into one of the most formidable systems of fortification the Allies had yet encountered. Another advantage they had over the Allies was that Kesselring, unlike General Alexander, did not have a mixed force with all the problems of having to spare the sensibilities of allied subordinates. And although Kesselring's own leadership left much to be desired, partly because of his effort to please his master, this was somewhat offset by the quality of his commanders at the corps and division level.

This, then, was the situation in which the Allies found themselves at the time Operation STRANGLE was launched on 19 March 1944. The efforts to break the GUSTAV Line through frontal assault had failed. The forces immobilized on the Anzio beachhead had been unable to break out, but the Germans also had to abandon their attempts to throw the invaders back into the sea.

A stalemate had set in. Both sides were exhausted from six months of bitter fighting in which they had taken heavy casualties and had suffered from the atrocious weather. General Alexander wanted his armies to stand down for rest and regrouping until he could get reinforcements and the weather had improved so as to enable him to exploit his superiority in mechanized equipment. His original plan had been to resume the ground offensive in the middle of April. For various reasons the date had to be postponed and the offensive was rescheduled for May 1944.

III. THE PLANNING

Genesis of STRANGLE

The enforced respite in the Italian campaign seemed the perfect opportunity to try a different strategy: to hold ground action to a minimum and let airpower show what it could do in an all-out attack on the enemy's supply system in Italy.

The idea of using airpower on a massive scale to smash the German resistance on the Italian front was not new. It had been urged by General "Hap" Arnold, among others, and was endorsed by General Eisenhower at the Cairo Conference in December 1943. But the attempts to use air in the traditional manner, by trying to blast a path for the ground forces through the heavily fortified German positions, had been unsuccessful, as proved by the costly assaults on Monte Cassino.

There was another way, however, of using the formidable airpower that was now available to the Allies. If the stubborn defenders could not be bombed into submission, perhaps they could be starved out by cutting off their essential supplies of ammunition, fuel, and other necessities. This would call for a major, concentrated effort; it would require a systematic campaign of "interdiction," as it was now called, against the entire supply network of the German armies in Italy.

Sporadic attacks on the enemy's rail and road communications had been carried out before, in Sicily and in the earlier Italian campaigns. Air Marshal Tedder and other air commanders were much impressed with a report that Professor Zuckerman* had submitted in December 1943 on the

---

*Sir Solly Zuckerman, before the war a professor of anatomy, served as scientific advisor to the RAF, eventually specializing in bombing tactics and target selection. His reputation was greatly enhanced through his contribution to the planning of the bombing campaign against the island of Pantellaria. At the time he prepared his report, *Air Attacks on Rail and Road Communications*, he was head of an RAF operations research group, called the Bombing Survey Unit, in Palermo, Sicily. His findings seem to have had a strong influence on Lord Tedder, who adopted Zuckerman's choice of railroad marshaling yards as the preferred target for interdiction. At Tedder's suggestion, Zuckerman was recalled to England in early 1944 to advise the OVERLORD planners on the use of airpower in the Normandy invasion.

results of these attacks. While these had only been occasional strikes they seemed to offer a potential that could be more fully exploited in a systematic and coordinated interdiction campaign. The time for trying it had come; in February 1944 the Supreme Allied Commander, Mediterranean, issued the first directive for the planning of what came to be known as Operation STRANGLE.

A sustained interdiction campaign on the massive scale envisaged for STRANGLE could not have been mounted earlier, while the ground fighting was still in full swing, because then the M.A.A.F. had to give priority to other missions in support of the Allied strategy. During the two critical operations at Salerno and Anzio, all available airpower was used to establish local air superiority in advance of the landings and to assist the ground forces on the beachheads. A continuous air effort was required to support the Allied armies throughout their slow advance up the Italian boot toward the GUSTAV Line and in their assaults upon that position. During all this time, the battle for air superiority was still going on until the Luftwaffe was gradually eliminated as an effective opposition. The interdiction attacks carried out prior to STRANGLE had to be fitted in when weather permitted and when no higher priority missions were required. This gave the Germans time to repair damaged LOCs since no sustained follow-up attacks were possible.

In March 1944 the time had finally come when a systematic and prolonged interdiction campaign could be mounted, with the prospect of better flying weather ahead, and with no need to divert major air resources to other tasks. The battle for air superiority against the Luftwaffe in Italy had been won, and the lull in the ground fighting freed the M.A.A.F. from the need to provide air support for the Allied armies. Except for occasional probing actions, the fronts remained quiet during the two months while STRANGLE was in progress.

This last factor was to have both a favorable and an unfavorable effect on the interdiction campaign, as will be discussed later in more detail. The favorable effect was that in the absence of ground action, the army commanders aggreed to release the fighter-bombers which had formerly been earmarked for close support. As it turned

out, they played a far more important part in the interdiction campaign than anyone had anticipated. The unfavorable effect was that the Germans were no longer forced to expend their precious ammunition and other combat supplies at high rates of consumption. This permitted them to conserve their stockpiles and even add to them while under heavy air attack.

The Objective

At the time, however, few Allied air officers worried about the reduced German consumption. They welcomed the lull in ground fighting because it released sorties that could now be employed in the interdiction campaign. And they needed all the sorties they could mount in order to achieve the ambitious objective they had set themselves in Operation STRANGLE.

In the words of the M.A.A.F. directive of 19 March 1944, the objective of the campaign was nothing less than *"To reduce the enemy's flow of supplies to a level which will make it impractical for him to maintain and operate his forces in Central Italy."*[*]

This sweeping language was not due to loose wording. An almost identical phrase was used in the earlier planning directive issued by General Wilson in February and repeated in Hq. M.A.A.F. Operations Instruction #8 on 18 February 1944: "... the principal object of the bombing effort of the M.A.A.F., except for POINTBLANK,[**] ... is to make it impossible for the Germans to maintain their forces in Italy on their present line by the disruption of their rail and sea communications upon which they must rely."[***]

---

[*] AAF History, Vol. III, p. 373.

[**] Operation POINTBLANK was the combined strategic bombing offensive which at this time was concentrated against German air force targets in preparation for OVERLORD. The strategic component of M.A.A.F., which alone had aircraft with sufficient range to reach interdiction targets in northern Italy, was only occasionally available for such missions. Its priority commitment was participation in POINTBLANK.

[***] M.A.A.F. Report, I, p. 5.

If this objective is to be interpreted literally, it meant that the German withdrawal from the GUSTAV Line was to be achieved *through air action alone*, without the need for ground fighting. That it was so interpreted at the time is confirmed by a letter General Eaker wrote to General Arnold on 7 April, after STRANGLE had been under way for some weeks. As the M.A.A.F. Commander saw it, "My personal belief is that our communication attacks will make it possible for the Army to move forward when they next make an effort ... I think when our ground forces move Northward it (sic) will, in fact, be following up a German withdrawal made necessary by his inadequate supply."*

This interpretation conflicts with the one advanced after the event. On 16 June 1944, after the battle for Rome had been won at the cost of 42,000 Allied casualties,** the M.A.A.F. Target Section published an *Assessment of STRANGLE and DIADEM* that contained a specific disclaimer of the earlier objective: "The operation against the Italian Lines of Communication was never expected to secure a withdrawal of enemy ground troops from the stabilized GUSTAV Line ... It was, in other words, a long-range type of ground-air support, related to and dependent upon large scale ground operations for consummation."***

But this was written when the campaign was over. It did not call attention to the fact that the original expectations had proved overly optimistic and had to be revised while STRANGLE was still going on. One of the men best qualified to bear witness to the change in objectives, since he played a major part in it, is Sir John Slessor, then the Deputy Commander of M.A.A.F.:

> After a conference on April 25 [1944] at which Wilson [SACMED] and his U.S. deputy, General Jacob Devers, Eaker and I discussed the air plan in full, a directive was issued on the 28th [April] which defined the object of the air operations as being to make it impossible for the enemy to maintain his forces on their present line in Italy *in the face of a combined Allied offensive*. A change in emphasis will be noted here

---

*M.A.A.F. Report, VII, Tab "S."

**Shepperd, p. 277.

***M.A.A.F. Report, VII, Tab "BB."

> which reflects our growing recognition that we had been unduly optimistic in our original hopes for STRANGLE in the directive of March 19.*

The more cautious wording of the new directive of 28 April represented not merely a "change in emphasis," as Slessor diplomatically called it. It was, in effect, a retreat from the original position that air action alone could force the German armies to withdraw from central Italy. But whether the change really marked "our growing recognition" of the limitations of interdiction, and how widespread that recognition was, is a matter of some doubt. It may not have been a change in thinking so much as a prudent concession to the realities of the situation.

When the decision was made to revise the directive, STRANGLE had been going on for well over a month and only two more weeks were left before the ground offensive was scheduled to begin. But in spite of encouraging reports about the damage inflicted on enemy communications, there was as yet no sign that the German front line troops were short of supplies or were preparing to evacuate their positions. Unless STRANGLE could accomplish miracles in the short two weeks still remaining, the GUSTAV Line would have to be taken by frontal assault. If the original wording of the directive had been allowed to stand it would have shown that the interdiction campaign had failed in achieving its objective.

The Curse of Success

Not surprisingly, the initial M.A.A.F. expectation that STRANGLE would make a ground offensive unnecessary had been treated all along with a good deal of scepticism by the Army planners who mistrusted the airmen's claims.** In M.A.A.F. Headquarters, however, the mood seems

---

*Slessor, p. 579. Italics mine.

**Brigadier W.G.F. Jackson, then on General Alexander's staff, recounts: "Moreover, he [General Alexander] was just as keen as Maitland Wilson [SACMED] to disrupt the German communications by air action. His only doubt lay in what he believed to be exaggerated claims by the Supreme Commander's air and scientific advisers as to the efficacy of the proposed interdiction plan which had been appropriately called Operation Strangle." W.G.F. Jackson, *The Battle for Rome*, B. T. Batsford Ltd., London 1969, p. 20.

to have been one of unreserved optimism, at least so far as is revealed in the contemporary accounts of the campaign and in other official sources. The private reservations expressed by Air Marshal Slessor in his report to Sir Charles Portal on 16 April were a notable exception. His critical appraisal of the STRANGLE results contrasts sharply with the rosy expectations his superior, General Eaker, had voiced in his letter to General Arnold only a week earlier.*

The lack of realism manifested itself not only in the overly ambitious objective set for STRANGLE but in the planning of the campaign itself. One gets the impression that the responsible officers were unaware of, or disregarded, the uncertainties and difficulties involved, and made little effort to understand the factors in the enemy's situation which were critical for the success of their task. This is only partly explained by the fact that interdiction doctrine was still in an experimental stage and that nothing as ambitious as STRANGLE had been attempted before. Nor can it be attributed solely to the wishful thinking of Air Force partisans who would not let doubts interfere with this opportunity to cement further the position of their service as the principal instrument of modern warfare. Both were contributing factors but there were other reasons as well for the overconfidence of the STRANGLE planners.

We must remember that the time was mid-1944, when airpower had reached a pinnacle of popular acclaim, before disillusionment with the strategic bombing campaign had begun to dim its luster and before the battles in Western Europe diverted attention to the role of the ground forces. Airpower had made incredible strides since the early days of the war. It had gratified the popular thirst for revenge against the Nazis by destroying their cities and industry; it had played an essential part in the defeat of the dreaded U-boats; and it had proved essential to the success of the Allied campaigns in North Africa and Sicily. At that point in time there seemed no limit to what airpower could accomplish; its advocates saw it as the wave of the future. At

*It is possible that General Eaker's private views were not quite as sanguine as his letter would indicate. General Arnold did not encourage pessimistic reports from his subordinates.

last, airmen seemed to have found the decisive, if not the absolute, weapon.

A few visionaries had long predicted that the new instrument of airpower would relegate the ground forces to a subsidiary role; the infantry would cease to be the "Queen of Battle," since airpower alone would be able to overwhelm the most heavily defended enemy position. After the spectacular successes of airpower in the bombing of Germany and in the Mediterranean campaigns, it no longer seemed preposterous for the M.A.A.F. planners to claim that they could force the retreat of German armies through air action alone. Operation STRANGLE was to test that claim. The airmen were obviously confident that the test would succeed or the original directive for the campaign would not have been worded the way it was.

If any further encouragement had been needed, there was the example of Pantellaria, which had been bombed into submission a few months earlier, in June 1943. The event was hailed as a triumphant vindication of the claims made by airmen. Pantellaria was a small Italian island in the Mediterranean, midway between Tunisia and Sicily. It was heavily fortified and defended by a mixed garrison of German and Italian forces. The Allies subjected it to an intensive air and naval bombardment for a month, preparatory to a land invasion. But the Italian commander of the island, seeing his fortifications reduced to rubble, sent a surrender signal to the Allied command in Malta. He did this before any ground troops had landed and without knowing that the invasion was already under way. Twenty minutes after he had sent his signal, the first Allied assault troops stepped ashore without meeting any opposition.

Air Marshal Tedder, one of the most far-seeing airmen of World War II, had been the Allied air commander at the time. He acknowledged that Pantellaria "was the first defended place to be reduced to surrender in the Second World War as a result of air and naval bombardment alone." But he also recognized the damage that could be done to the cause of airpower by distorting the significance of this incident. In his report to the RAF Chief of Air Staff in London he sent a prophetic warning that was all too soon borne out by events:

> I have pointed out here again and again right from the beginning that this operation [the bombing of Pantellaria] is a most valuable laboratory experiment. The conditions are not such as we are likely to have again, e.g., no enemy air worthy of the name, an extremely limited objective and consequent ability to concentrate a terrific scale of effort on a very small area. Despite all I have said, however, even Eisenhower has now begun to say, can't we possibly do something like this for HUSKY [the Sicilian campaign]. In short, I can see Pantellaria becoming a perfect curse to us in this manner.*

The curse foreseen by Lord Tedder manifested itself in many different ways. One of them was the overconfidence that pervaded the planning for the STRANGLE campaign.

The German Supply System

Apart from the intangibles that accounted for the atmosphere of optimism in M.A.A.F., there were also what the planners considered to be tangible reasons for their confidence. They believed that the German supply network in Italy was vulnerable to a sustained and systematic interdiction campaign on the scale of STRANGLE--as indeed it was, though not nearly as vulnerable as they thought, and only if one disregarded German ingenuity and years of experience in coping with disrupted LOCs.

But to an observer accustomed to the vast logistic apparatus behind the Allied forces, the supply situation of the German armies in central Italy may well have seemed truly precarious. Occupied Italy was more of a drain than an asset to the Germans. Production in the industrial north had been disrupted by Allied bombing and by the political upheavals following upon the defection of the Italian government. The distribution system was functioning so poorly that the Germans had to divert some of their own transport capacity to feed the hungry population of Rome and other cities. Ammunition, motor fuel and most other supplies, and troop reinforcements for the German armies in central Italy had to be brought in from occupied France, Austria, and Yugoslavia all the way across northern Italy.

---

*Tedder, p. 443.

For the long-haul transport required to bring in these supplies, the Germans depended on virtually a single source: the Italian railway system. Coastal shipping by small craft and motor transport--what there was of it--could move supplies over shorter distances, but was no substitute for long-haul rail movement into Italy. Shipping and motor transport both had limited capacity. The coastal waters were dominated by the Allied air forces and navies, making it unsafe for German shipping to venture out in daytime. M.A.A.F. Intelligence estimated that the water route could handle an average of 700 tons daily, with a possible increase to 900 tons in an emergency.

The motor transport situation was also precarious. There was a shortage of trucks, spare parts, and tires. Motor fuel had been in short supply for a long time and was strictly rationed. Parts for the Italian trucks commandeered by the Germans were difficult to come by since the factories in northern Italy had been bombed by the Allies. The Italian truck drivers were unreliable and frequently involved in accidents. Despite the scarcity of motor transport, some of it had to be diverted to the provisioning of Rome. A German quartermaster officer reported that in April 1944 the motor transport capacity allotted to Kesselring's Army Group for military use had been cut down to 800 tons daily.* Most of this transport was needed to haul supplies from the railheads to forward depots and for lateral traffic.

Since the Germans were so dependent on the Italian rail network, the Allies planned to "strangle" that network by establishing an interdiction belt across the width of Italy. The belt was to be bounded by two imaginary lines drawn across Italy north and south of Florence; the northern from the vicinity of Spezia to Rimini on the Adriatic, the southern from around Cecina to Ancona, as shown in Fig. 1.

An Allied intelligence appreciation gave the pre-STRANGLE capacity of the Italian rail network in the interdiction belt through which the trains had to pass on their way to the front as about 80,000 tons per

---

*Oberstleutnant Ernst Eggert (G-4 in the Chief Quartermaster Section of Army Group "C"), *Supply During Allied Offensive May 1944 and Subsequent Fighting to the Apennines*, MS D-128, p. 2.

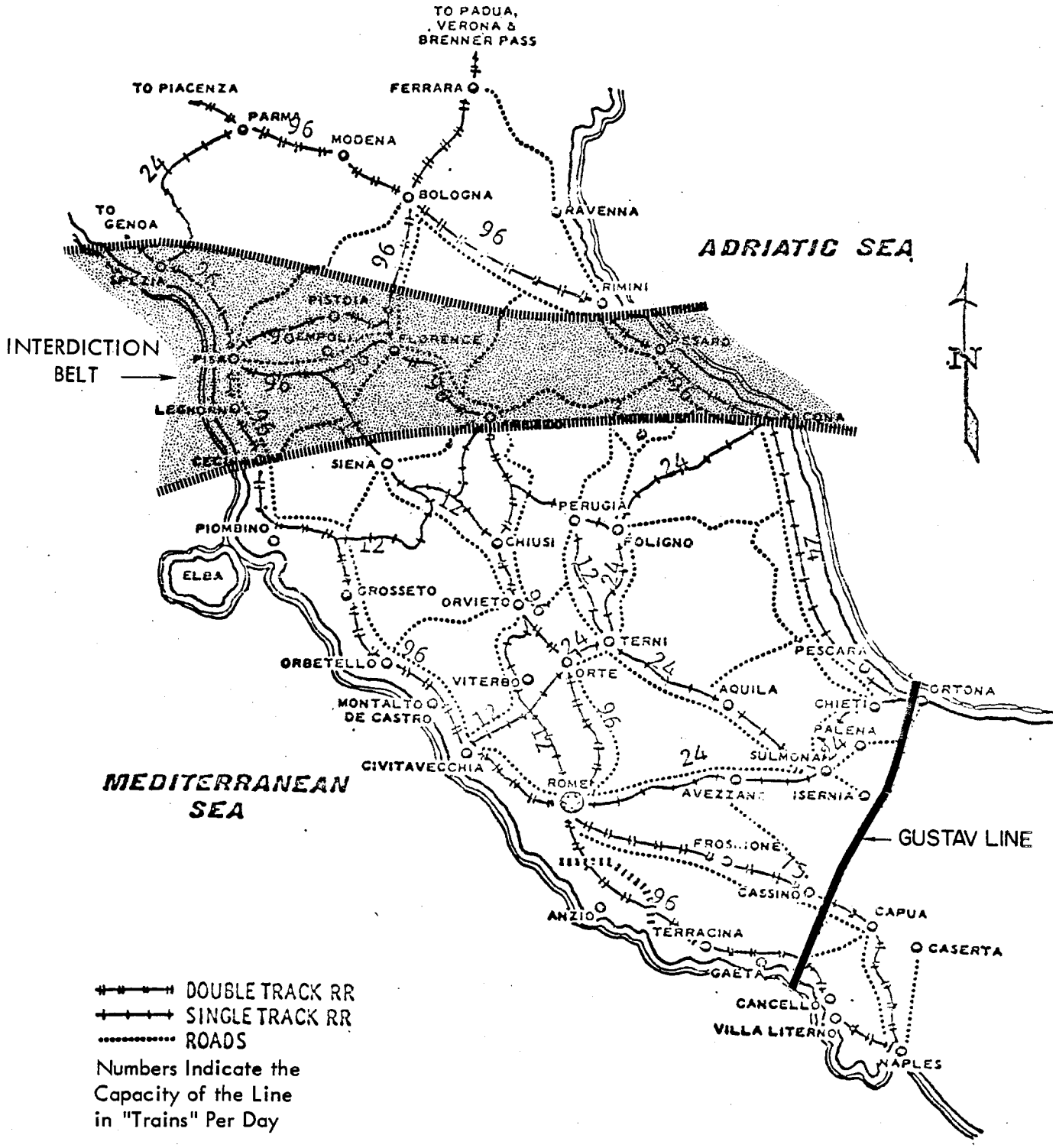


Fig. 1—Central Italy

day.* This was enough to supply the needs of the German armies many times over, even on the basis of M.A.A.F.'s own, unrealistically high estimate that during periods of intensive ground action Kesselring's forces would require a maximum of 5500 tons per day, or about 7 percent of the network's capacity. The task of throttling down the excess capacity until "the German armies could no longer maintain themselves" should have given the planners pause.

It would have been an easier task if the interdiction belt had been placed south of Rome, where the rail network began to thin out and its capacity was much smaller. There were only three rail lines from Rome to the front, and one of them was a single-track line while another--the main line along the coast--was severed by the Anzio beachhead. There were two more single-track lines from the north that bypassed Rome and led to Sulmona and Ortona, respectively. But these railheads served the Adriatic sector of the GUSTAV Line, which was expected to remain quiescent. Supplies shipped to this end of the Line would therefore have to be transferred to the active sector of the front in the south by other means of transport, chiefly trucks and animal-drawn carts.

Nevertheless, the STRANGLE plan was to concentrate on the supply network north of Rome. The most distant targets, chiefly marshaling yards in northern Italy, were assigned to the long-range bombers of MASAF. Attacks within the interdiction belt itself were to be carried out mainly by MATAF's medium bombers. The primary targets for the light bombers and fighter-bombers of the XII Air Support Command (ASC) and of the British Desert Air Force (DAF) were also in the area north of Rome, between Rome and the southern interdiction line. They were permitted, however, to use rail and road communications in the area south of Rome as secondary targets. This area turned out to be the major hunting ground for the fighter-bombers.

The main reason the planners had chosen to concentrate the interdiction effort in the area north of Rome was that they wished to

---

*M.A.A.F. Report, VII, Encl.: Hq., MATAF, *Report on Operation "STRANGLE."*

cut the rail lines as far from the front as was feasible, in order to maximize the distance over which supplies would have to be transshipped by other means of transport.* Another reason was that the targets close to the battle area were to be reserved for attack in the period immediately before and during the ground offensive. It was hoped that this would make it impossible for the enemy to repair damage and replenish his forward stockpiles in time to meet the attack.**

What has been said so far about the task that the M.A.A.F. had set themselves in Operation STRANGLE does little to justify their confidence in the success of the interdiction campaign. As indicated earlier, that confidence need not have been based on facts; it may have stemmed merely from the atmosphere prevailing at the time. There are indications, apart from the wording of the STRANGLE directive, that at least at the time the campaign was launched no serious attempt had been made to analyze the task that lay ahead. The M.A.A.F. historian, certainly not a hostile observer, remarked: "Just when STRANGLE began is hard to define. As we have seen above the philosophy behind the program was murky, to say the least, until April first. Indeed, the final Air Plan for DIADEM, defining STRANGLE as the "preparatory phase," did not appear until 28 April."***

Consumption Needs of the German Armies

The philosophy appears to have remained murky, not until 1 April, but until 28 April, or more than six weeks after STRANGLE had been launched and when only two more weeks remained to go. For it was only on 28 April that the M.A.A.F. Intelligence Section issued an Appreciation, as part of the Air Plan for DIADEM, which seems to have been the first attempt to estimate the supply requirements of the German armies in numerical terms.****

---

*M.A.A.F. Report, VII, Tab "BB."

**Author's interview with Major General Gordon P. Saville, USAF (Ret.), then Commander, XII ASC.

***Narrative, p. 195.

****M.A.A.F. Report, I, Tab "D."

An estimate of this sort should have been available from the beginning; in fact, it should have been the basis for planning an interdiction campaign aimed at supply denial. If it was not known how much the German armies needed to sustain themselves, how could one be sure that enough supplies could be withheld to achieve the STRANGLE objective? Whatever the reason why the need for such an estimate had not been recognized earlier, by the end of April the situation confronting M.A.A.F. had changed in two important respects. By then it had become apparent that in spite of STRANGLE the German armies were receiving enough supplies to support them in the absence of sustained ground action. The other change was that the revised STRANGLE directive of 28 April belatedly admitted that air action alone could not do the job and that a ground offensive was needed to drive the Germans out of central Italy. The task for STRANGLE, therefore, had become one of withholding the *additional* supplies the enemy would need to fight off the Allied ground assault.

In its 28 April Appreciation, M.A.A.F. Intelligence calculated that during the period from 15 March to 25 April the German consumption of supplies that had to be brought down from northern Italy had averaged 4000 tons per day. It was believed that the Germans had managed to bring in this tonnage, despite the damage inflicted on their railroad system by the Allied interdiction attacks, only by straining their available motor transport to the utmost. This was expected to become a crucial factor during the imminent Allied offensive.

German supplies stored in forward and rear depots and with front line units were estimated to include 30 days of ammunition and 10 days of fuel, both calculated on the basis of sustained combat needs. This estimate in itself should have been a matter of concern to the M.A.A.F. planners, for it would have been unusual for intensive combat to be sustained for as long as 30 days without the attacker having won his objective or been repelled and forced to regroup. The ten days of fuel supply probably could have been stretched further through the draconic economy measures the Germans had learned to adopt. It also must be kept in mind that these figures represented an Allied intelligence estimate. The Allies could not be sure that the actual stock levels may not have been higher.

The crucial part of the estimate related to the amount of supplies the German armies were believed to need while defending against the Allied ground assault. Because of the increased expenditure of ammunition and fuel during a period of heavy fighting, the German requirements were expected to rise to 5500 tons per day, or 1500 tons more than the enemy was thought to be getting during the STRANGLE campaign. It was believed that he would not be able to meet this additional requirement. In the words of the Intelligence Appreciation:

> In conclusion, therefore, it can be said that at the present time [28 April], despite two lines of interdiction on his rail communications and regular attacks on ports, shipping and M.T., the enemy can provide his minimum requirements, but this performance is unlikely to be capable of substantial increase. An increase of some 200 tons per day would, however, be possible in shipborne supplies. It is therefore appreciated that, if the present state of affairs can be maintained, the enemy will be unable to meet some 1300 tons of his daily requirements during sustained operations.*

These, then, were the figures on which the hopes for the success of the interdiction campaign were based. They were totally wrong.

They were wrong not only in hindsight, as revealed by the German Quartermaster records captured after the war.** They were wrong even in light of what was known, or should have been known, at the time of STRANGLE.

To start with, the relatively narrow gap between the 4000 tons estimated to be the daily requirement of the German armies while the front was inactive, and the 5500 tons believed to be needed for sustained fighting should have been suspected all along.

A U.S. War Department manual published on 1 March 1945 gave German Army consumption figures during the Russian campaign of 1941. At that time, when the Germans could still afford relatively lavish expenditures of ammunition and even fuel, "Armored divisions averaged some

---

*M.A.A.F. Report, I, Tab "D."

**The figures obtained from these records will be discussed later in this paper. They are reproduced in Appendix A.

30 tons daily when inactive and about 700 tons a day when engaged in heavy fighting; infantry divisions required 80 tons a day when inactive and some 1100 tons during a day of heavy fighting."*

The key variable that accounted for this tremendous spread between the requirements of an active and inactive front was of course ammunition; fuel also contributed to the variation in consumption. The War Department manual allowed for the fact that by 1945, and even earlier, ammunition and fuel expenditures had been severely curtailed, even during periods of heavy fighting. It therefore estimated that under current (1945) conditions, the German armies consumed approximately five times as much when engaged in heavy defensive fighting as they did when the front was inactive. But this is still a much greater spread than M.A.A.F. Intelligence allowed for. Moreover, the German supply situation at the time of STRANGLE, though ammunition and fuel were already rationed, was not yet as precarious as it became a year later when the War Department manual was issued. It is likely, therefore, that in the spring of 1944 the variation in German army consumption between active and inactive periods, though not as great as in 1941, was at least on the order of 5 to 1, and probably greater. It was certainly nowhere near the Allied estimate of 1.4 to 1 (5500 tons versus 4000 tons).

The M.A.A.F. Intelligence officers had assumed that the 4000 tons which they believed the Germans were able to bring in during STRANGLE--a figure which itself is highly questionable--were what the armies needed to sustain themselves while the front was quiet. If the assumption was wrong, as it undoubtedly was, and if supplies were really arriving at the rate of 4000 tons a day, the surplus could have been used to build up the enemy's stockpiles against the anticipated Allied offensive.

The other error was in estimating that Kesselring's Army Group actually would require 5500 tons per day during intensive combat. In a situation such as the one prevailing in 1944, when the Germans had

---

*_Handbook on German Military Forces_, War Department Technical Manual E-30-451, 1 March 1945, Ch. VI.

long been trained to husband their precious supplies of ammunition and fuel, the armies could not afford to consume supplies at anything near the rate assumed in the M.A.A.F. estimate.

It is instructive to compare this estimate with one made by a German army itself, when it found itself in a somewhat comparable situation, at the end of a tenuous supply line and forced to conserve its resources even while engaged in heavy defensive fighting. When the German Sixth Army under General Paulus was encircled at Stalingrad at the end of 1942 it depended on airlift for its supplies and therefore had to make a careful estimate of its requirements. It was a large force comprised of 14 infantry divisions, 3 motorized divisions, and 3 armored divisions, plus 2 Rumanian divisions and various special units. On paper, the force totaled 330,000 men, though its actual ration strength was around 300,000 men. Allowing for units and individuals outside the cauldron, approximately 220,000 men were left within the surrounded area. To supply their total needs during the expected period of intensive combat, the Sixth Army asked for an airlift of 700 tons per day. It subsequently scaled down this request to 500 tons per day, since the Luftwaffe could not make good on Göring's promises.*

Compare the 700 tons that the Sixth Army itself estimated as its daily requirement with the 5500 tons which M.A.A.F. assumed to be needed by Kesselring's Army Group. Yet the two armies under Kesselring totaled only 19 combat divisions, against the 22 plus divisions which Paulus had to supply.

There is no indication that the M.A.A.F. intelligence officers were aware of the figures on German army consumption in the Russian campaign of 1941 or during the Stalingrad siege. Else it is hard to explain how they could have so grossly overestimated the German requirements in Italy.

---

*As it turned out, the best the Luftwaffe was able to do was to supply an average of around 100 tons per day. See: Walter Görlitz, *The Battle of Stalingrad 1942-3*, in H. A. Jacobsen and J. Rohwer (eds.), *Decisive Battles of World War II: The German View*, G. P. Putnam's Sons, New York, 1965, pp. 243-244.

One factor that may have been responsible is the common tendency of intelligence agencies to apply the mirror image approach to the enemy. In view of the lavish expenditures of the Allied armies, not only of ammunition but of all other kinds of supply, it must have been difficult for the M.A.A.F. planners to believe that a frugal enemy could get by with so much less. How little he was forced to get by with can be seen from the plaintive entries in German war diaries, comparing Allied ammunition expenditures with their own. General Heinz Greiner, then the Commander of the 362 Infantry Division, noted in February 1944, before STRANGLE had begun, that on "quiet" days Allied artillery fired 25,000 rounds against 1500 rounds fired by the Germans![*]

Target Selection

Although the estimates of German consumption were, or should have been, the key to the planning for STRANGLE, they were introduced so casually in the Intelligence Appreciation, and so late in the game, that their importance could not have loomed very large in the eyes of the operational planners. What concerned them as far more important was the choice of targets for the interdiction campaign. On this subject a good deal of controversy had been going on in the Italian theater ever since Professor Zuckerman had published his famous report on the attacks on marshaling yards.[**]

If Professor Zuckerman and those who agreed with him had had their way, marshaling yards again would have been chosen as the highest priority targets for the STRANGLE campaign. For a time, during the preliminary planning for STRANGLE, they were indeed so designated. But there were a number of senior air officers in the theater whose experience led them to take issue with Zuckerman's conclusions. Among them was the M.A.A.F. commander himself, who wrote to General Devers on 1 April 1944:

---

[*] Generallieutenant Heinz Greiner a.D., *Kampf um Rom - Inferno am Po*, Kurt Vowinckel Verlag, 1968.

[**] See p. 16, above.

> All our experience in attacks on communications in this theater has shown that even the most successful bombardment of a marshaling yard does not cut traffic for more than a few hours. Attacks on marshaling yards are valuable more because they destroy concentrations of goods, rolling stock and repair facilities. We have found that a more permanent way to cut lines is by attacks on bridges and viaducts which are more difficult to repair.*

General Eaker and others thought that the best way of choking off supplies to the front was through the "complete, simultaneous and continuous" cutting of all German supply lines within the interdiction belt established north of Rome. They wanted special attention given to such choke points as railway bridges and viaducts, which Professor Zuckerman had considered "uneconomical and difficult targets [that] in general do not appear to be worth attacking."**

As is so often the case, the controversy ended in a compromise when it was decided to treat the Italian rail network as a target *system* and to attack all elements of the system, including marshaling yards, bridges, tunnels, defiles, and even open stretches of track. The strategic attacks on marshaling yards in northern Italy were to be carried out by MASAF when they were not engaged in POINTBLANK operations. The tactical air forces were charged with the interdiction of the rail and road network itself, which was the real heart of the STRANGLE campaign.

Without anticipating the results of STRANGLE, which will be discussed later, it might be mentioned here that the opponents of attacking marshaling yards were proved right. We have it on the authority of the German officer in charge of the Italian Transport System that traffic from and to Germany was slowed up but never stopped because of the bombing of marshaling yards in northern Italy. Damage to the yards was repaired quickly since the location of the attacks could be anticipated and the Germans had assembled repair crews and material near the threatened spots. The main effect of the bombing was the

---

*M.A.A.F. Report, VII, Tab "R."

**Narrative, p. 189.

destruction of goods and rolling stock.* As the interdiction campaign went on, the Germans did precisely what some Allied officers had predicted they would: the marshaling yards were only used for civilian freight while military supplies were shipped in trains that were made up across the frontier and run as close to the front as the damaged rail lines permitted.

The attacks on railroad bridges, viaducts, and road bridges, on the other hand, turned out to be among the most lucrative of the campaign.** In the mountainous terrain of central Italy a bridge over one of the many deep gorges represented a choke point that was difficult or impossible to bypass when the bridge was destroyed. To repair these often elaborate structures took time and required skilled crews and bridge repair equipment which were in short supply. Neither was it possible to replace such mountain bridges with underwater emergency bridges as the Germans were able to do in the flat terrain of the Liri valley.

One reason why Professor Zuckerman and others had favored larger and more concentrated interdiction targets was that bridges had proved difficult to hit in the earlier high level attacks by heavy and medium bombers. In STRANGLE, however, the M.A.A.F. had acquired a new and more effective weapon for attacking small targets when the Army agreed to release the fighter-bombers that had formerly been earmarked for ground support. While they could not carry enough bomb load to destroy massive bridges, fighter-bombers achieved greater accuracy than the mediums against the less substantial bridges. Their average was one hit per 19 sorties, while the best record for the medium bombers was one hit per 31 sorties. Another advantage was that the fighter-bombers could often fly when the mediums were grounded by weather, and could therefore interfere with German repair efforts. The target

---

*Oberst Klaus Stange, G.S. (G.O.C. in charge of the Italian Transport System), *Railroad Situation from January 1944 Up to the Beginning of the May Offensive (Italy)*, MS D-049.

**Air Marshal Slessor, who originally had been opposed to bombing bridges, later changed his mind and noted that experience had invalidated Zuckerman's conclusions. Slessor, p. 568.

priorities assigned to MATAF's light* and medium aircraft were as follows:**

Medium bombers	1. Major bridges 2. Marshaling yards and repair shops
Fighter-bombers	1. Active trains 2. (a) Tracks (b) Major bridges under repair 3. Secondary bridges

The great success of the fighter-bombers in their new interdiction role had been unexpected. Toward the end of STRANGLE and during DIADEM they hit not only bridges and railroad tracks but also road junctions, moving traffic on the roads and rails, and supply depots in the forward areas. Their effectiveness in these attacks, and the disruption caused by them, called attention to the importance of such targets, which had heretofore been regarded as secondary.

On the other hand, the heavy bombers of the Fifteenth Air Force, of which much had been expected, made only a minor contribution to the interdiction campaign. Their effort, in terms of sorties flown and bombs dropped, was by no means negligible.*** But the results were disappointing, simply because damage to the marshaling yards in northern Italy, which were their primary target, proved to have little effect on the German supply situation. The official History concedes that the heavy bombers had not accomplished much in their tactical interdiction role:

> They hit ten major targets, damaging trackage, rolling stock, and installations and blocking - at least temporarily - most through lines. At Milan, in particular, the attacks were most successful. It is important to note, however, that Strategic's attacks on

---

*The light bombers and fighters of the XII Air Support Command and of the Desert Air Force also participated in the interdiction effort when not engaged in air superiority operations.

**Narrative, p. 206.

***MASAF flew 19,700 effective sorties and dropped 33,500 tons during the entire campaign. *Ibid.*, p. 202.

> yards accomplished only a small reduction in the enemy's flow of supplies, for main through lines were quickly repaired or traffic was diverted to by-pass lines. The truth is that it was the work of Tactical's mediums and fighter-bombers against bridges, rail lines, and M/T that made STRANGLE a success.*

Just how much of a success STRANGLE had been is a matter to which we must now address ourselves.

---

*AAF History, Vol. III, p. 381.

IV. THE EFFECTS ON GERMAN SUPPLY

As They Appeared to the Allies

It will be recalled that the original interdiction concept for STRANGLE had been based on the assumption that massive air attacks on the enemy's supply system could make a ground offensive unnecessary or turn it into the mere pursuit of his withdrawing armies. This concept was retained until it became evident, near the end of STRANGLE, that things were not working out as hoped, and that a full-scale ground and air assault on the GUSTAV Line would be required. Henceforth the impression was given that STRANGLE had been planned from the start as the "preparatory phase" of a continuing interdiction campaign and that its purpose had always been to assist the forthcoming ground offensive. Its sponsors preferred to forget that they had ever entertained the notion of STRANGLE as a self-contained operation which could in itself be decisive.*

Disregarding the important conceptual differences between the two phases of the interdiction campaign, M.A.A.F. officers understandably based their appraisal on the overall results of the entire campaign, as they appeared at the end of DIADEM, instead of trying to separate out what interdiction had accomplished before the ground offensive was launched. As we shall see, this makes the M.A.A.F. accounts, as well as the subsequent histories based on those accounts, a less than satisfactory source for assessing the results of STRANGLE alone.

For our purpose, however, such an assessment is needed. Although the original concept for STRANGLE was disavowed, this was a matter of expediency rather than conviction. The concept reflected a deeply held belief that has had a lasting effect on Air Force interdiction doctrine. The results of STRANGLE may provide clues to the viability of the concept itself, as distinct from its unsuccessful application in this particular instance, which could have been due to circumstances.

---

*Pages 18-20, above.

Another important reason for trying to identify the effects of STRANGLE is that it was one of the few tactical air campaigns in World War II in which it is possible to observe the results of air interdiction alone, undiluted by the contributing effect of other arms. During the DIADEM phase, Allied artillery inflicted heavy destruction on the same kinds of communication targets--road junctions, moving traffic, and forward depots--that were also singled out by the fighter-bombers shortly before and after the ground offensive began. This makes it difficult to sort out the results of the joint effort, even though the fighter-bombers concentrated on targets that were beyond artillery range, and each service tried to keep its own box score of results.

The M.A.A.F. assessment of the STRANGLE results would have been more helpful if its authors had applied their own criterion:

> The estimate of the success of the aerial phase of this combined operation depends therefore upon the extent to which shortages were actually created *up to the time of the Allied Ground Offensive.**

Unfortunately, this prescription was not followed. The M.A.A.F. accounts speak of the "collapse of enemy supply" *during* DIADEM, which they attribute partly to the delayed effects of STRANGLE, but have little to say about the supply situation *before* DIADEM, beyond admitting that it did not become critical until the ground offensive was underway. In discussing the effects of STRANGLE--insofar as any attempt is made to separate them from those of DIADEM--the emphasis is all on the damage inflicted upon the enemy's transport system and not on what this did in withholding supplies from the German armies. The former was undoubtedly easier to observe and to assess than the latter.

In recounting the damage that STRANGLE had done to the enemy's transport facilities, M.A.A.F. could indeed point with pride: "... the number of cuts [of Italian rail lines] existing on any particular day rose steadily from an average of 25 at the end of March to an average of 75 by mid-May... On several days in May the number of claimed

---

*M.A.A.F. Target Section, *Assessment of STRANGLE and DIADEM,* M.A.A.F. Report, VII, Tab "BB." Italics mine.

and confirmed cuts exceeded 100 ... at no time since 24 March did any through traffic reach Rome. Most of the time traffic was interrupted 125 miles from the capital..."*

In the eyes of the M.A.A.F. observers the breaks in the rail lines had a bonus effect that may have been even more important than the disruption of rail traffic which was the intended objective. The Germans were forced to use their already inadequate motor transport to transship supplies between the cuts and even to move troops and supplies over longer distances normally covered by rail. This provided a new and lucrative target system for the Allied fighters and fighter-bombers. M.A.A.F. concluded that the depletion of the enemy's motor transport capacity as a result of these attacks, both during STRANGLE and DIADEM, had critically hampered his supply movements during the ground offensive and thus had been a major factor in the defeat of the German armies.

This conclusion is shared by the author of the official Army Air Force History, who paints a vivid picture of the traffic stagnation caused by STRANGLE:

> Well before the end of STRANGLE the rail lines were in such bad shape that most movement below the Pisa-Rimini line was by motor transport alone, and a large part of that was over secondary roads. As soon as the Germans began to shift from rails to roads Tactical's fighters and fighter-bombers, bombing and strafing, ripped into the enemy's motor transport. By 11 May they had destroyed an estimated 800 vehicles and damaged close to 1000. Although the Germans supplemented their own M/T with several thousand requisitioned Italian vehicles (whose drivers proved to be distressingly unreliable), by the end of STRANGLE the destruction wrought by MAAF's planes, together with overuse and inadequate repairs, had taken such a heavy toll that the enemy's road transport was incapable of handling the demands of both the forward and rear zones of communication. Nor could he improve the situation by an increase in coastal shipping, for MAAF's attacks on ports and surface craft had reduced that type of transportation to an unimportant minimum.**

---

*_Ibid._

**AAF History, Vol. III, pp. 382-383.

The damage to the enemy's transport system, which is given such prominence in these accounts, undoubtedly cut down the amount of supplies reaching the German armies. But how great that reduction was, and now much the damage that had been inflicted "well before the end of STRANGLE" contributed to the alleged breakdown of the enemy's supply system during DIADEM, are different matters.

Damage to transport facilities is not readily translatable into supplies withheld. Cuts in rail lines can be repaired or by-passed, rolling stock can be replaced, alternative means of transport can be improvised, and what is available can be stretched through more economical utilization. Moreover, the need for transport itself can be reduced through stricter rationing of supplies already in the combat zone and by drawing on the supply cushion held in Army depots. All these measures and many others were taken by the Germans, who had become past masters in adapting themselves to disrupted lines of communication.

If the enemy's transport system was really in such bad shape before DIADEM, as painted in the AAF History, how was it able to deliver the 4000 tons a day which M.A.A.F. believed the Germans were getting all during STRANGLE? And was it possible to calculate the net impairment of the capacity of the system so precisely as to say that although it was able to handle 4000 tons a day, it would not be able to manage the additional 1500 tons thought to be needed during the forthcoming offensive?

On these points, though directly relevant under M.A.A.F.'s own criterion, the official accounts contain little information. Here is what the M.A.A.F. Target Section has to say in its *Assessment of STRANGLE and DIADEM* about the supply situation of the German armies before the offensive began:

> There is abundant evidence that long before D-Day [DIADEM], due to the disruption of transport plus direct attacks on supply depots, the enemy troops were short of food and clothing. Both motor fuel and certain types of heavy ammunition were severely rationed. Nevertheless, it is probable that so long as the front remained static and quiet the enemy's supply situation was not highly critical.

> With the opening of the offensive, particularly once the front lines had shifted, it was, ironically, this very employment of M/T in place of the long distance rail transport that appears to have been the cardinal factor in the collapse of enemy supply...*

Yet we know that motor fuel and ammunition for the German armies in Italy and elsewhere had been rationed long before STRANGLE began. The German economy was already strained to the point of requiring stringent conservation measures for essential supplies on all fighting fronts as well as in the Reich itself. The disruption caused by STRANGLE made the supply situation in the Italian theater more difficult, but whether it created "shortages" depends on the standards used. What the Allies, in their abundance, interpreted as shortages may have been merely the frugal standards the Germans had been forced to adopt after five years of war.

The official AAF History is equally prone to shift emphasis from the supply situation before DIADEM to the delayed effects of STRANGLE as they manifested themselves during the ground offensive:

> The first point to note is that the ultimate objective of STRANGLE, which was to make it impossible for the enemy to maintain his armies south of Rome, could not be achieved until the Allied armies in Italy forced him into a real battle... But as soon as the Germans were involved in a major fight it was immediately evident that STRANGLE had fully accomplished its purpose: the interdiction of supplies, the cutting of rail lines, and the destruction of motor vehicles had so crippled the enemy that he speedily used up his stores and motor transport, lost his mobility and had no choice but to retreat. The effects of STRANGLE then turned an orderly withdrawal into a rout.**

This approach of course makes it impossible to separate the STRANGLE results from those of the even more intensive interdiction campaign waged during DIADEM,*** let alone from the effects of the ground offensive itself.

---

*M.A.A.F. Report, VII, Tab "BB."

**AAF History, Vol. III, p. 395.

***During DIADEM, M.A.A.F. flew close to 73,000 sorties and dropped 51,500 tons of bombs, as against 65,000 sorties and 33,000 tons of bombs

If we find these accounts of the STRANGLE results less than satisfactory, allowance must be made for the fact that the authors, though obviously sincere in their efforts to be objective, were not exactly disinterested observers. If they were disappointed in what had been accomplished prior to the ground offensive, it would have been only natural for them to pass lightly over the results of STRANGLE and concentrate on the contribution--indeterminable though it was--that STRANGLE had made to the spectacular success of DIADEM.

Reading between the lines of the official accounts, a fair interpretation of the authors' real conclusions, so far as STRANGLE itself was concerned, might run as follows:

- o STRANGLE disappointed its sponsors in that it did not achieve its original objective of reducing below the essential minimum the supplies the Germans needed while the front was inactive.
- o Although the damage inflicted during STRANGLE on the enemy's rail system did not have the hoped-for, immediate effect on his supply situation, it had a delayed and indirect effect that had not been anticipated. By forcing the Germans to substitute motor transport for rails, it caused scarce trucks and motor fuel to be used up and exposed to Allied attack. The resulting shortage of motor transport was a prime factor in the "collapse" of the German supply system during DIADEM.
- o STRANGLE did create supply shortages of various kinds and reduced German ammunition stocks to 30 days supply and fuel stocks to 10 days supply. These shortages were not critical until the ground offensive began.

Freely translated, this means that the hope that the Germans could be defeated by air action alone was not fulfilled and that it required a combined ground and air assault (DIADEM) which STRANGLE was to have made unnecessary.

While most M.A.A.F. officers may have been reluctant to admit the limitations of interdiction, even after the event, at least one

---

during STRANGLE. The bomb tonnage dropped on interdiction targets alone was 38,200 tons during DIADEM and 22,500 tons during STRANGLE. Narrative, pp. 202-203.

participant not only admitted them freely but had predicted them halfway through STRANGLE. He was Air Marshal Slessor, General Eaker's Deputy, whose report on the interdiction campaign and whose role in getting the STRANGLE directive changed were mentioned earlier in this paper.*

On 16 April, the Air Marshal, "having an idle moment," reported his impressions of STRANGLE in a personal letter to the Chief of the Air Staff in London. The letter deserves to be read in full, but can only be summarized here briefly.** Even at that early date, it was evident to Slessor that despite the damage done to the enemy's railroads and motor transport, the German armies were not hurting for supplies and even managed to build up their stockpiles in the forward depots. He attributed this partly to the bad flying weather in Italy during February and March which permitted the Germans to repair damaged lines of communication and move in supplies while the Allied air forces were grounded. He also remarked on what he called "the unsurpassed capacity of the Hun's Q staff to keep him supplied in almost impossible conditions"--a capacity they had acquired the hard way, through long experience in dealing with disrupted LOC's. As we shall see, the Germans managed to keep up the flow of supplies even during the good flying weather in April and May and to build up the stocks in their units and depots so as to provide a cushion against the period of heavy fighting that lay ahead.

Among other important reasons for the disappointing effects of STRANGLE on enemy supply, Slessor mentioned the frugal living standards of the German armies. By doing without the luxuries and amenities that were regarded as indispensable on the Allied side--USO shows, coca-cola, motorized transportation--the enemy was believed able to subsist on something like one-fourth or one-fifth of the daily tonnage required by an Allied force of the same size. The excess capacity of the German transport system, coupled with the difficulty of stopping night traffic by small coastal craft, was another major factor cited in Slessor's report.

But in his opinion the crucial point was that German ingenuity in maintaining the necessary flow of supplies during STRANGLE worked

---

*See footnote, p. 8. Also pp. 18-20, above.

**Slessor, pp. 570-577.

only because in this period they were not forced to expend fuel and ammunition. While he acknowledged the need of Alexander's armies to rest and regroup for the forthcoming offensive, he felt that they would pay dearly for this prolonged period of inactivity. By husbanding his supplies during these two months, the enemy would be able to accumulate enough, if not to take the offensive, to offer a vigorous defense that could make the Allied assault a costly enterprise.

This last point alone goes far to explain why Sir John Slessor had given up his earlier hope that supply denial could be achieved without the need for ground action that would impose heavy consumption on the enemy. And in abandoning this hope, he also had to change his belief in interdiction as a self-contained operation, divorced from a ground offensive. But his mind was too flexible to fasten on supply denial as the sole objective of interdiction. He was aware that air-power could make a possibly more important contribution by denying the enemy armies their power of movement while under attack, when mobility would be at a premium. Some of his thoughts on this broader subject were included in the report to Sir Charles Portal and in a subsequent paper he wrote for General Arnold after the fall of Rome. They will be discussed elsewhere in this study.*

What the German Records Show

If the contemporary M.A.A.F. accounts of the German supply situation were fragmentary and, as will appear presently, wide of the mark, this is altogether understandable. The damage done to the enemy's transport system could be confirmed through direct observation after the area had been conquered. But what this damage meant, in terms of supplies withheld, had to be deduced and pieced together from the interrogation of prisoners who are notoriously unreliable reporters and

*A discussion of this subject here would break the continuity of thought. The present section is devoted to the results of STRANGLE in terms of the objective sought, which was supply denial. The disruption of mobility, which would have been a more rewarding objective to pursue, deserves a fuller treatment than could be given to it at this place in the narrative.

usually are limited to a worm's eye view of the situation. It is to be regretted, however, that this somewhat uncritical acceptance of prisoners' tales about supply "shortages" also found its way into the official Army Air Force History published many years later.

Since the end of World War II a variety of German sources has become available in the form of contemporary quartermaster records, war diaries of the units fighting in central Italy, transcripts of the post-war interrogation of German commanders involved in various campaigns and supplementary accounts prepared by them for the U.S. Army Chief of Military History, as well as book-length memoirs by high-ranking German officers.*

The outstanding fact to emerge from the German records is that *there were no critical supply shortages, either during STRANGLE or even during DIADEM.* Spot shortages of certain items inevitably developed in the midst of the offensive, and especially during the German retreat after the CAESAR Line had been breached in the first days of June. But these were due to distribution difficulties and not to a shortage of supplies in the theater.

The G-4 in the Chief Quartermaster Section of Kesselring's Army Group Headquarters summed up the supply situation existing at the end of May as follows:

> Through the above mentioned measures to arrive at the highest possible transportation efficiency and by using all forces to the utmost degree, it had always been possible for the Army Group, until the beginning of the withdrawal fighting, to place at the disposal of the armies the necessary means for their plan of action in ample time and in sufficient quantity, despite the increasing critical transportation situation. The ammunition situation was

---

*To the best of my knowledge, the first systematic use of such records for an analysis of STRANGLE was made by the Office of the Assistant Chief of Staff, Studies and Analysis, Headquarters, United States Air Force. The results were published under the title: *The Uncertainty of Predicting Results of an Interdiction Campaign*, Saber Measures (Alpha), December 1969. The study was done under the direction of Mr. Robert E. Schmaltz (AF/CSAG), who generously made his voluminous "Data Bank" and other source material available to the author.

> decidedly favorable; on the other hand, the gasoline situation, though still fair, required economical management. The ration situation was assured.
>
> But opposed to this general supply of the armies pictured as adequate during during the defensive fighting, local combat areas suffered from lack of ammunition, gasoline and rations as a result of difficult distribution to the units, caused by the nature of the fighting and especially by the extraordinarily strong influence of the allied air force day and night.*

It will be noted that the conditions just described were those prevailing during DIADEM when heavy consumption was imposed on the enemy and when his supply system was under both air and ground attack. The supply situation prior to DIADEM is rarely mentioned in the German records for the simple reason that it presented no problem at that time. The disruption of the transport system during STRANGLE did create great difficulties for the German support service, but they were not insoluble and did not keep the supplies from going through. The German officer in charge of the Italian Transport System commented at length on the difficulties created by Allied air attacks on the railroad network and on the measures taken to deal with them. His conclusion was:

> Traffic within the country had to be further curtailed, movement across the frontiers had to be slowed down. Nevertheless, it was possible to repair all these damages within a comparatively short period of time and in an adequate manner to permit railroad operations to continue and the trains required by the Heeresgruppe [Army Group "C"] to be moved in.**

These two quotations give a picture so much at variance with the impression conveyed in Allied accounts that one may question the validity of the authors' conclusions. The monographs from which the quotations are taken were prepared in 1947 as part of a historical project by the U.S. Army under which former German officers who had held key

---

*Eggert, *Supply During Allied Offensive*, MS D-128, pp. 6-7.

**Stange, *Railroad Situation*, MS D-049, pp. 8-9.

positions in World War II were asked to provide their recollection of events in which they had participated. Since most of them were given no access to their own World War II records, it is quite possible that their memory, after the lapse of several years, may have tricked them into seeing the past in a rosier light than they should have. In the case of the two officers concerned--one in charge of the transport system, the other holding a key position in supply--it would have been natural for them to want to show how successful they had been in overcoming the difficulties confronting them.

But this explanation is too simple. The conclusions of these officers are borne out by the accounts of their customers, namely the commanders of the fighting units, whom one might expect to dwell on supply difficulties to account for their reverses in the battle. Yet the daily entries in the war diaries of such key units as the German Tenth Army and the XIV Panzer Corps do not mention any supply shortages even during the heaviest battles for the GUSTAV Line, until the latter part of May when the front began to collapse and when Allied air and artillery attacks had created a chaotic situation on the supply roads. Even then, the spot shortages were ascribed to the difficulty of moving the supplies, not to their lack of availability. This is also the theme stressed in the post-war accounts of other operational commanders, from division commanders up to Field-Marshal Kesselring himself. In his Concluding Assessment, the Commander-in-Chief, speaking of the period 15-18 May, stated that "The supply situation was satisfactory."*

Even under the extraordinarily difficult conditions created during the German retreat, the troops did not seem to be lacking essential supplies. One of the officers close to the scene, the commander of the 26th Panzer Division, recounted some of the harrowing details of the retreat over choked mountain roads from Frosinone to the area north of Rome (1-5 June). Yet, "Despite of all difficulties the supplies for the Division were always on the spot on time so that the troops

---

*Generalfeldmarschall Albert Kesselring, *The Campaign in Italy, Part II*, MS C-064, p. 45.

were able to cross this particularly dangerous sector without completely getting out of order."*

Since these accounts all deal with the period while the ground offensive was going on, they bear on the results of STRANGLE only insofar as the air attacks during the "preparatory phase" are supposed to have so weakened the German supply system that it "collapsed" under the demands made on it during DIADEM. But there is no evidence in the German records that this had been the case. The supply difficulties the Germans had to surmount, which were enormous, were not due to supply shortages but to the problem of distribution *within the combat zone*.

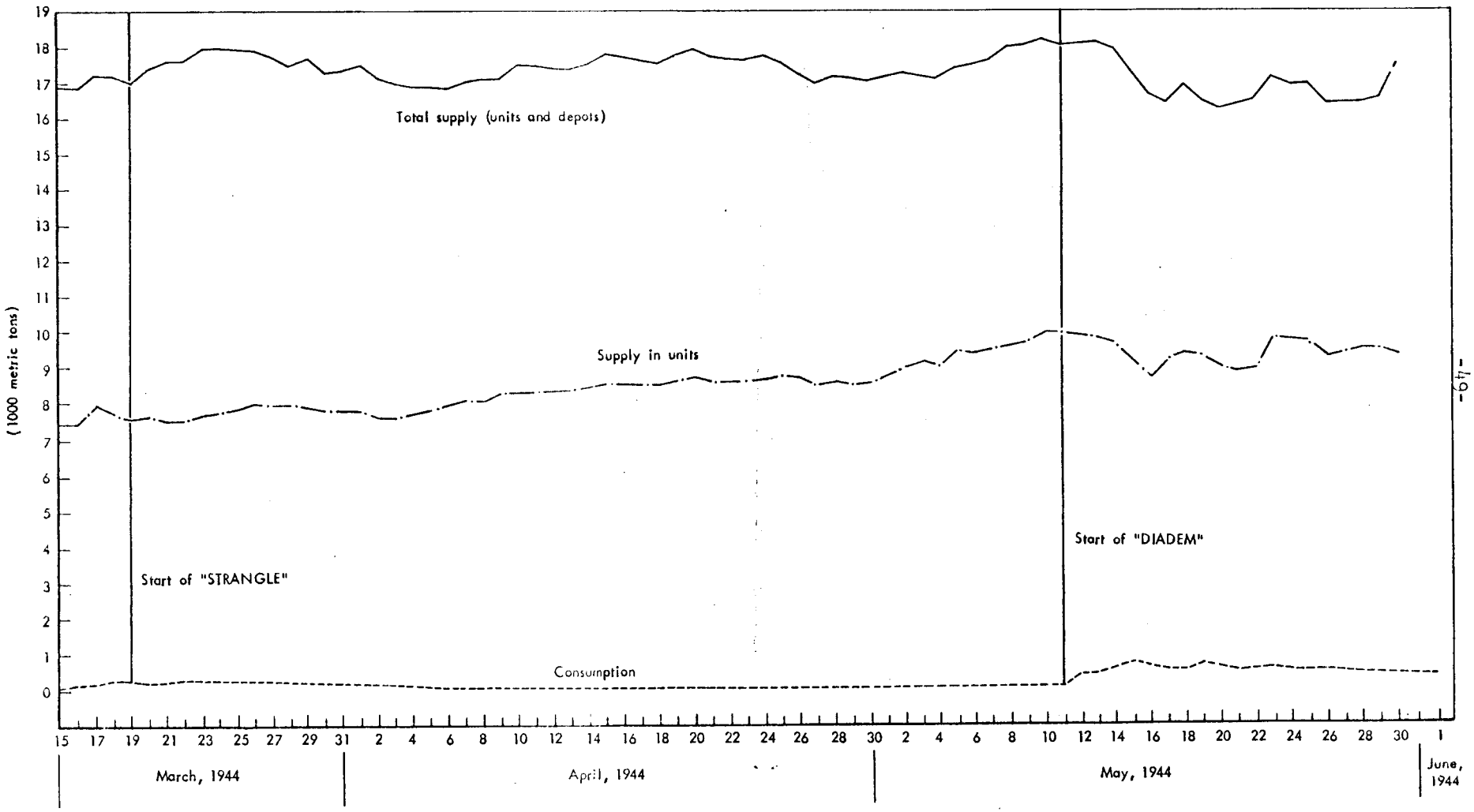
Fortunately, on the subject of the overall availability of supplies we need not rely on personal reminiscences but can look at the contemporary German Quartermaster records. The critical items were of course ammunition and fuel. The charts on the following five pages (Figs. 2-6) show at a glance what the supply situation actually was in the Tenth and Fourteenth German Armies, both during STRANGLE and during the first half of DIADEM. The daily figures from which the charts were drawn will be found in Appendix A.**

Let us first look at the picture so far as ammunition is concerned. Up to the beginning of DIADEM, ammunition stocks in the two German armies showed a substantial increase, from 32,743 to 37,456 tons, despite the transport difficulties created by the STRANGLE attacks. To be sure, ammunition expenditures during this period were low and evidently less than the amount arriving at the units and depots. What is even more remarkable is the relatively insignificant reduction in overall ammunition stocks during the heavy fighting after DIADEM began, when average

---

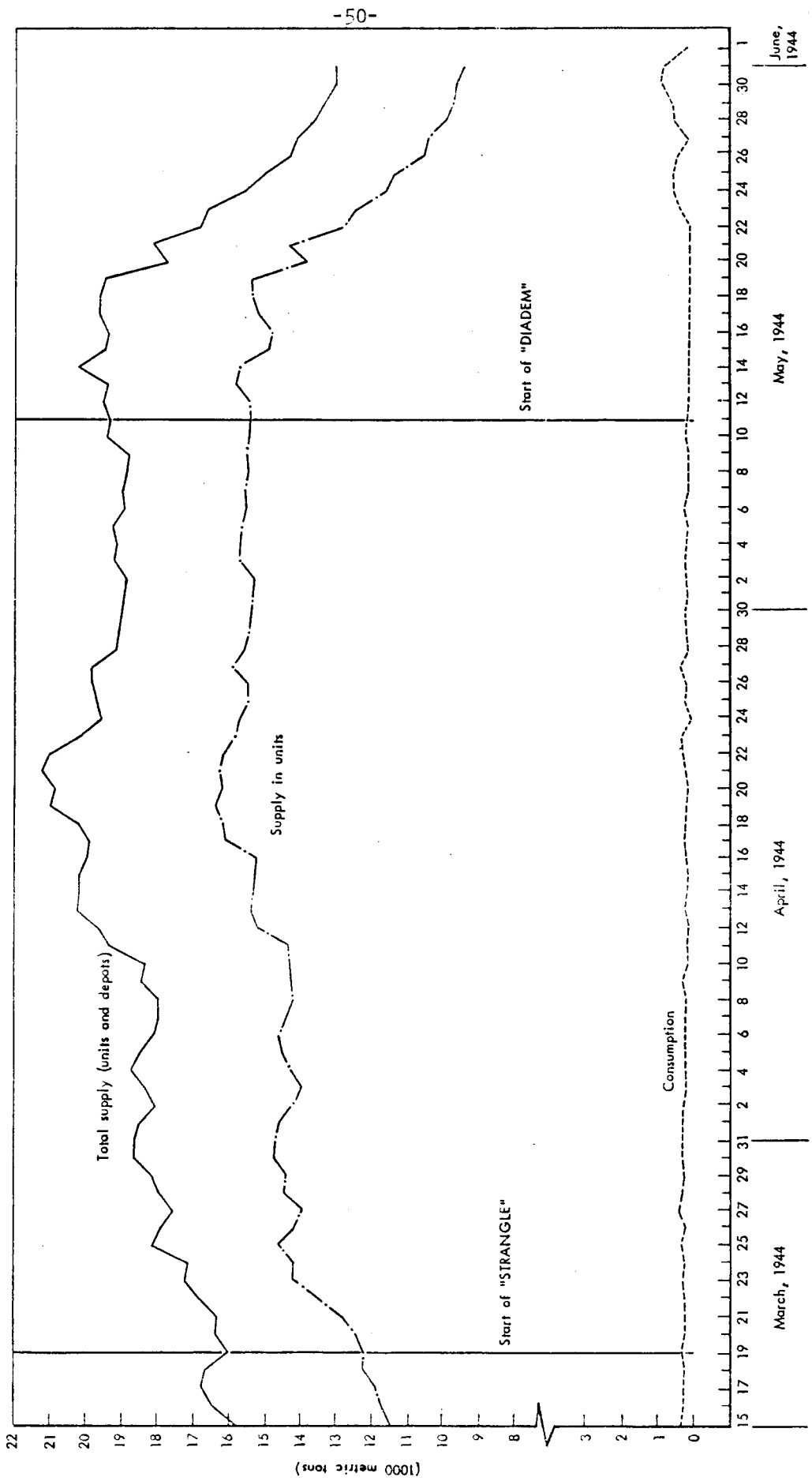
*General der Panzertruppen Freiherr v. Lüttwitz, *The Employment of the 26th Panzer Division from 15 May 1944 to 12 July 1944 in Italy*, MS D-312, p. 12.

**The figures were obtained through the courtesy of Mr. Robert E. Schmaltz, of the Office of the Assistant Chief of Staff, Studies and Analysis, Headquarters USAF, who had them transcribed from the original German Quartermaster records available in microfilm at the U.S. National Archives (see footnote, p. 45, above). They were not verified by the author. Some of the fuel figures were converted from cubic meters to metric tons, for the sake of better comparability.



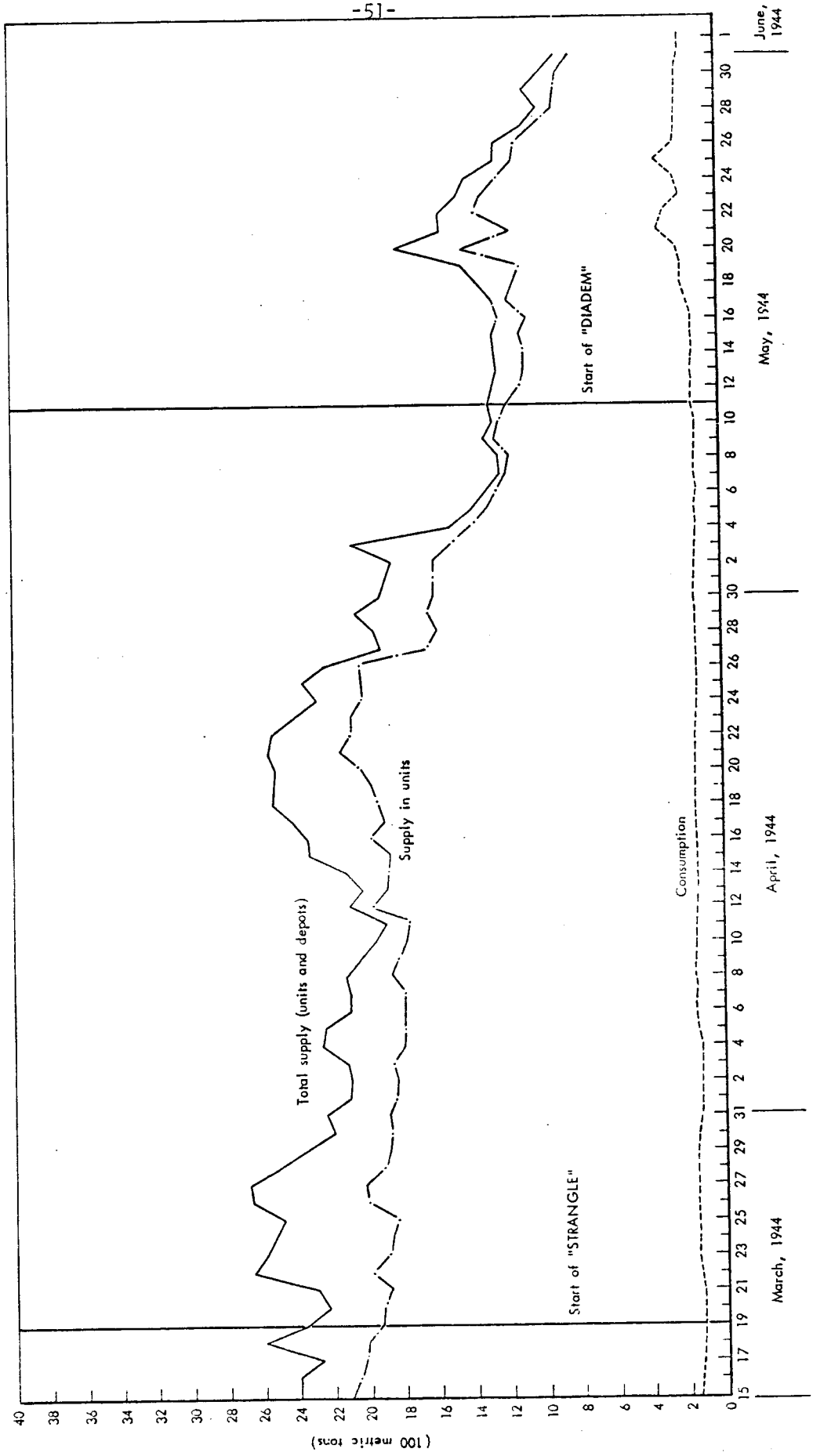
Source: "Data Bank" maintained in HQ., USAF (AF/SAG). Based on German Quartermaster records. For actual figures, see Appendix A.

Fig. 2—Daily ammunition supply and consumption -- 10th German Army



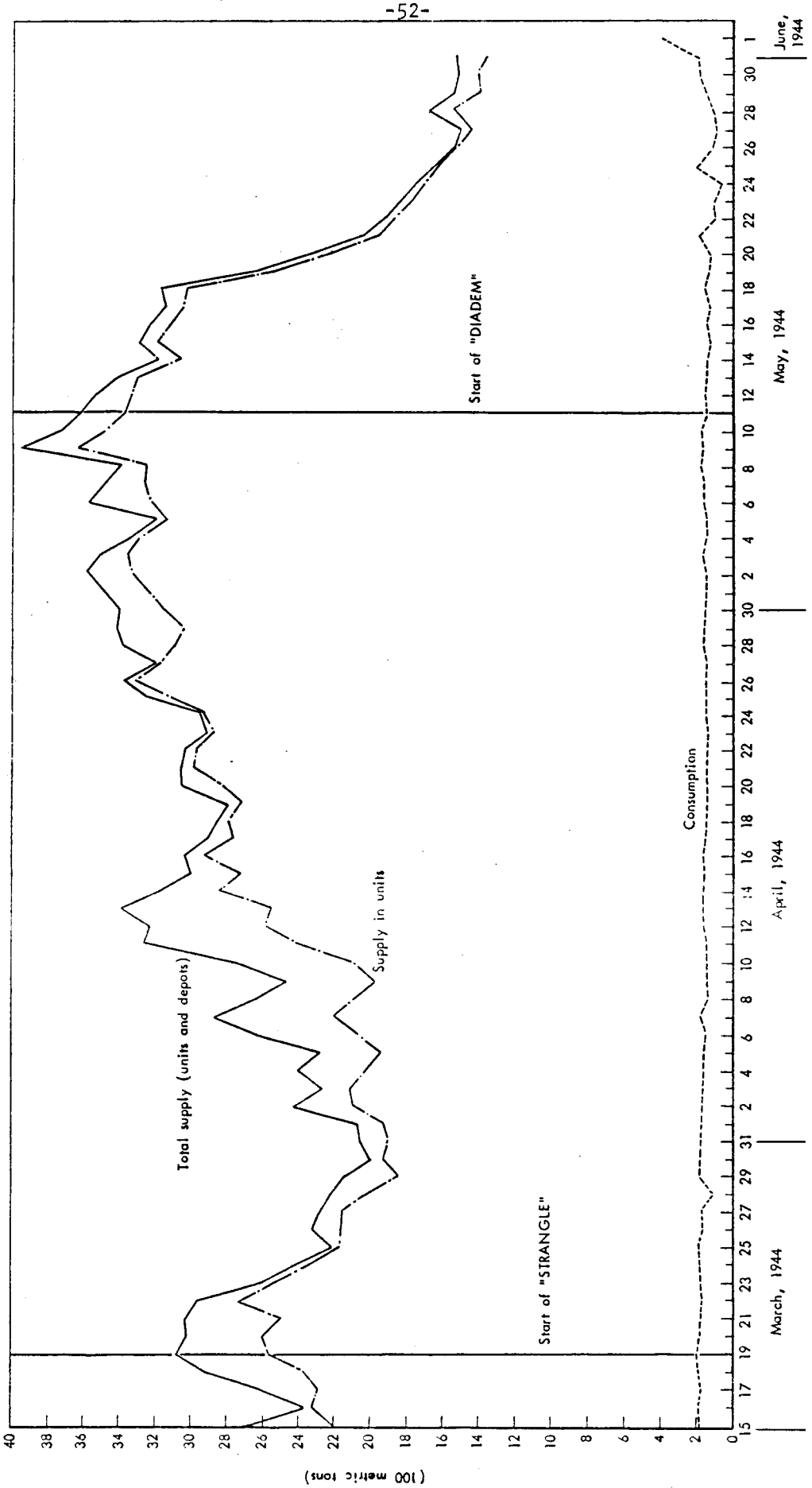
Source: "Data Bank" maintained in HQ., USAF (AF/SAG). Based on German Quartermaster records. For actual figures, see Appendix A.

Fig. 3—Daily ammunition supply and consumption -- 14th German Army



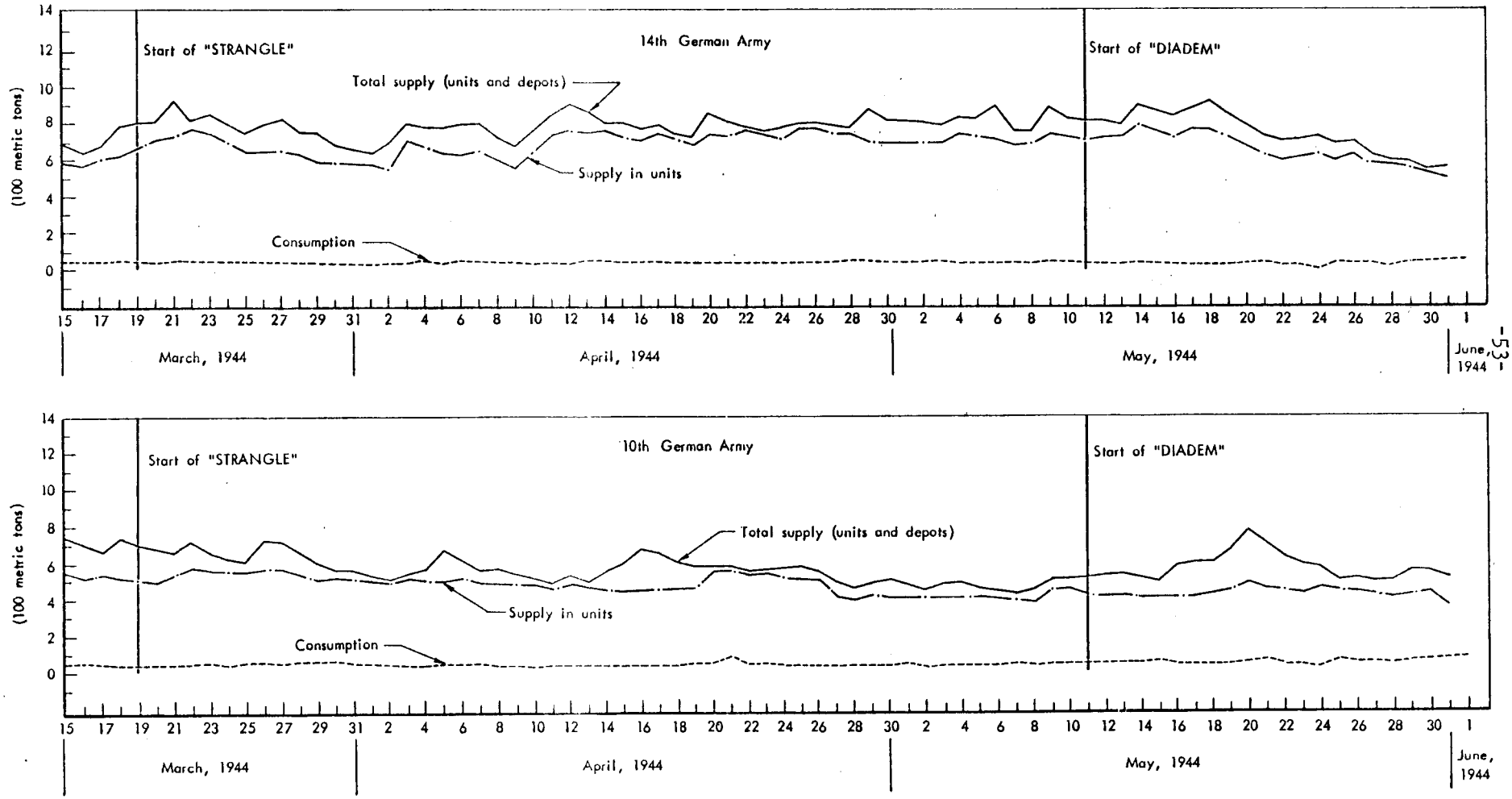
Source: "Data Bank" maintained in HQ., USAF (AF/SAG). Based on German Quartermaster records. For actual figures, see Appendix A.

Fig. 4—Daily fuel supply and consumption -- 10th German Army (gasoline only)



Source: "Data Bank" maintained in HQ., USAF (AF/SAG). Based on German Quartermaster records. For actual figures, see Appendix A.

Fig. 5—Daily fuel supply and consumption -- 14th German Army (gasoline only)



Source: "Data Bank" maintained in HQ., USAF (AF/SAG). Based on German Quartermaster records. For actual figures, see Appendix A.

Fig. 6—Daily fuel supply and consumption -- 10th and 14th German Armies (Diesel only)

daily ammunition expenditures were around four or five times of what they had been during STRANGLE.

As can be seen from the summary in Table 1, below, total ammunition supplies available to Kesselring's armies rose during STRANGLE from 32,743 tons on 15 March to 37,456 tons on 11 May when the ground offensive began. Yet by 30 May, the beginning of the precipitate German retreat, total ammunition supplies had shrunk only to 30,565 tons, or less than 7 percent below what they had been at the start of STRANGLE. Since ammunition consumption for the period 11 to 30 May totaled almost 17,000 tons while the available stocks declined by only 7000 tons, it is clear that supplies continued to arrive even during DIADEM, and were still sufficient at the end of May to sustain 30 days of heavy fighting. (There were only a few days in May when daily consumption exceeded 1000 tons.)

Table 1

AMMUNITION SUPPLY IN DEPOTS AND UNITS OF THE TENTH AND FOURTEENTH GERMAN ARMIES AT THREE KEY DATES, 1944
(in metric tons)

	15 March	11 May	30 May
Tenth Army			
Depots	9,380	8,104	8,200
Units	7,511	9,998	9,380
Total	16,891	18,102	17,580
Fourteenth Army			
Depots	4,381	3,965	3,344
Units	11,471	15,389	9,641
Total	15,852	19,354	12,985
Army Group "C"			
Depots	13,761	12,069	11,544
Units	18,982	25,387	19,021
Total	32,743	37,456	30,565

Source: See Appendix A.

So far as the supplies of automotive fuel were concerned (Figs. 4 and 5), we know that the Germans were in a tight situation and had to practice drastic economy measures. This is also shown by the fact, illustrated in the charts, that the bulk of the fuel was held by the units and only small amounts were in depots. It is probable that the fuel depots were used mainly as reservoirs to facilitate distribution of incoming supplies, and that fuel was kept there only until it could be picked up by the unit supply columns. Nevertheless, the available fuel supplies seem to have provided a fairly comfortable cushion all during STRANGLE. They showed a sharp decline when DIADEM began, but even at the end of May the stocks in the units had not yet been exhausted. Though the fuel situation obviously was less reassuring than the ammunition situation, neither can be held accountable for the German defeat, which was accomplished while there were still sufficient supplies of both at hand. The difficulty of moving these supplies in the midst of heavy fighting to the right places at the right time was a different matter that had little to do with the total amounts available in the combat area.

The charts also show that there were marked differences between the two German armies in the way their supply levels changed during the interdiction campaign. The increase in the ammunition stocks during STRANGLE was greater in the Fourteenth Army than in the Tenth. But after the attack on the GUSTAV Line began, the supplies of the Tenth, which bore the brunt of the attack, remained fairly steady while those of the Fourteenth showed a sharp decline that began when its sector of the front was still quiet, prior to the breakout from the Anzio beachhead on 23 May. Another puzzling feature is the build-up in the automotive fuel stocks of the Fourteenth Army during the last three weeks of STRANGLE, whereas those of the Tenth were substantially reduced in the same period. After DIADEM, the Fourteenth again shows the same early and sharp drop in fuel supplies that we noted in the case of ammunition, with a relatively smaller decline in the stocks of the Tenth.

It is easy to understand why the Germans gave highest priority to the build-up of ammunition and fuel stocks during STRANGLE since they

knew that a major Allied offensive was impending. But why did they pile up more ammunition, and especially more of their precious fuel, in the Fourteenth and not in the Tenth, which had to defend the all-important GUSTAV Line? And why did the stocks of the Fourteenth begin to decline before there was any fighting on that sector of the front?

The differences in the supply levels of the two armies are difficult to account for without a great deal more research than was possible to do for this study. But they seem to have been the result of deliberate decisions by the German command rather than of supply difficulties created by the Allied attacks.

One might speculate, for instance, that the reason for favoring the Fourteenth Army in the build-up of supplies prior to DIADEM was Kesselring's misreading of Allied intentions. We know that General Alexander's deception plan for DIADEM had succeeded brilliantly in convincing the German commander that the Allies were planning another amphibious landing north of Rome, probably combined with an airborne assault on his rear area, and that the attack on the GUSTAV Line would be mainly for the purpose of pinning down the German forces there. If this had indeed been the Allied plan, the main burden of defense would have fallen on the Fourteenth Army. This is why Kesselring held his mobile reserve divisions in that sector where they would be in closer proximity to the likely spots where the Allies might land. And since they would have to move quickly in order to repel a landing it would have been reasonable to provide the necessary fuel stocks in advance. It could be a possible explanation for the increase in the fuel supplies of the Fourteenth Army during the latter part of STRANGLE, after Kesselring had convinced himself that this was what the Allies were intending to do.*

---

*Kesselring's reasoning was not shared by General v. Vietinghoff, the commander of the Tenth Army, nor by the latter's subordinate, General v. Senger, who had made an outstanding record as a corps commander in the defense of the GUSTAV Line. V. Senger correctly anticipated the real Allied attack plan but was repeatedly overruled in his requests for reinforcements and supplies to strengthen what he rightly considered to be the main front.

By his own admission, the Field-Marshal stuck to his conviction for a few days after the attack on the GUSTAV Line had begun. He still expected an Allied landing elsewhere and was therefore reluctant to commit his reserve divisions. It was not until 14 May that he ordered the 26 Panzer Division transferred out of the still quiet Fourteenth Army sector to the Tenth Army, which was fighting superior Allied forces and had no reserve divisions of its own. Another reserve division (29 Panzer Grenadier) was to follow a few days later. It was the beginning of frequent transfers of units or parts of units between the two armies. The movement was not all in one direction; exhausted divisions that had fought in the GUSTAV Line were withdrawn to quieter sectors in the north or on the Adriatic for rest and regrouping.*

The transfers of units out of the Fourteenth Army during the first two weeks of DIADEM could account for the reduction in its supplies before the fighting around Anzio began. It could also explain why the supplies of the Tenth Army, which had been heavily engaged from the first, showed no greater decline than they did. It seems likely that the ammunition, fuel, and other supplies that the transferred divisions carried with them were deducted from the quartermaster records of the Fourteenth and added to those of the Tenth. The consumption of fuel in the process of moving down to the GUSTAV Line must have also contributed to the early drop in the fuel supplies of the Fourteenth.

While it is only possible to speculate on the tactical decisions that could have resulted in the supply differences between the two armies, they seem to offer a more logical explanation than the assumption that these particular differences could have been caused by a shortage of supplies or transport.

The German records discussed so far have shown the supply situation in overall terms. They have not enlightened us on the shortages in specific items, such as heavy ammunition, which the Allied accounts

---

*After both fronts had become engaged and the fighting developed into a war of movement, changes had to be made in corps and army boundaries, with corresponding changes in the assignment of divisional and smaller units to different commands. This adds to the difficulty of keeping track of the units and their supplies assigned to the respective armies at any given time.

claim to have occurred "well before the end of STRANGLE." The War Diaries of the Tenth Army and of the XIV Panzer Corps do indeed mention temporary spot shortages of ammunition, fuel, food, and other items, generally in isolated units that were fighting in exposed positions and were difficult to reach by supply columns. These references, however, all relate to the period after the ground offensive had begun. The first mention of ammunition problems in the Tenth Army War Diary is in its Situation Report for 16 May:

> Ammunition situation in LI Corps [on the German left wing, in the mountainous Cassino area] is tenuous because of movement difficulties created by constant fighter-bomber attacks and destruction of roads.*

There are similar references in subsequent entries, but all describe the shortages as temporary, lasting a few days at the most. The cause is usually attributed to air attacks and the blocking of roads by air and artillery action carried out during DIADEM. There is no mention of ammunition shortages, other than the need to ration expenditures, during STRANGLE. Neither is there any indication in the later entries that the difficulties occasionally encountered during DIADEM were related to the effects of the earlier STRANGLE attacks on the rail network.

The daily Ammunition Status Reports of the Tenth Army, showing types of ammunition, allowed and on hand, in the individual divisions and depots, offer partial confirmation that at least up to 20 April there were no critical shortages in any items.** A comparison of the Ammunition Reports for 1 April and 20 April shows that there were no

---

*Army Diary, p. 85.

**Appendix A, Tables 4, 5. The Ammunition Status Reports are part of the enclosures to the War Diary kept by the Operations Branch, Headquarters, Tenth Army (*Kriegstagebuch #6, Abtlg. Ia, AOK 10*). The Diary itself is complete and includes the daily Situation Reports for the entire period of STRANGLE and DIADEM. The Ammunition Status Reports, however, are only available through 20 April. The records of Tenth Army Headquarters had to be dug out of the ruins of the Operations building when it was destroyed by Allied bombing at the start of DIADEM. It is evident that some records could not be salvaged.

significant changes in ammunition allowances, or shortfalls against allowances, between these two dates. As of 20 April, some divisions had overages in certain items. There were no major reductions in depot stocks either, except for one particular depot (*"Maulwurf"*) which was successfully bombed in early April.*

The changes that did occur prior to 20 April probably can be explained by fluctuations in the tactical conditions facing different divisions and by the vagaries of transport into and out of the depots. To be sure, STRANGLE still had almost three weeks to go. It is possible that shortages in certain types of ammunition developed during the period for which we have no Ammunition Status Reports. But if these shortages had been critical they certainly would have been mentioned in the daily Situation Reports which are available for all of STRANGLE and DIADEM.

It seems safe to conclude, therefore, that the supply situation of the German armies during STRANGLE was not nearly as bad as the Allied accounts would have us believe. Critical items like ammunition and fuel arrived in sufficient quantities to increase the stock levels in the units and depots, and there were no spot shortages in individual items that caused the Germans any real trouble until DIADEM. The STRANGLE attacks served to aggravate the problems the Germans faced later, but they were problems of distribution and movement within the combat area and were not caused by stopping supplies from reaching central Italy.

---

*See Table 5, Appendix A.

V. THE POSITIVE RESULTS

In the preceding section, the results of STRANGLE were examined in terms of M.A.A.F.'s own criterion: supply shortages created up to the time of the Allied ground offensive. Measured in those terms, and in those terms only, STRANGLE would have to be adjudged a failure. Even when German consumption rose steeply during DIADEM and when their supply system was exposed to both air and ground action, the German armies did not lack essential supplies.

This negative verdict, however, only applies to the specific objective the Allied airmen had set themselves but failed to achieve. In this particular instance, supply denial turned out to have been the wrong objective. Yet, while pursuing that objective, the interdiction campaign--especially during the DIADEM phase and less so during STRANGLE--achieved something else which was not consciously sought but played a crucial part in the success of the ground offensive. The attacks on vital communication links which were intended to throttle German supplies had other effects as well: they severely curtailed the tactical mobility of the German armies, imposed costly delays on the movement of troops and supplies, played havoc with the enemy's plans and timetables, forced the diversion of scarce military personnel to a vast repair effort, and created such disorganization in the combat area that only German military discipline could prevent it from becoming utter chaos.

These were among the real achievements of interdiction. If its results were judged by other criteria than supply denial, a very different picture would emerge. The German commanders, at least, considered the impairment of their tactical mobility as a result of the Allied interdiction attacks one of the key factors in their defeat.

What is surprising is that the Allied airmen--again with some notable exceptions--did not recognize during or even after the campaign that they were pursuing the wrong objective. Apart from the sorties diverted to air superiority and close support operations, M.A.A.F.'s main effort even during DIADEM was still aimed at achieving supply

denial, as it had been throughout STRANGLE. The attacks on the railway network continued, even while the ground offensive was reaching its climax. As late as the end of May, a few days before the fall of Rome, MASAF's heavy bombers were still hitting marshaling yards in northern Italy and southern France.

> The decision to launch DIADEM as soon as practicable caused no change in the activities of the air forces, which kept right on hitting lines of communication. By mid-April the success of STRANGLE had become so evident that clearly the best contribution which the air arm could make to the approaching ground offensive was to continue the program. Accordingly, when the outline air plan for DIADEM was issued on 28 April, two of the principal jobs given to the air forces were simply continuations of STRANGLE: to keep the GAF in its present state of ineffectiveness; to maintain the current interruption of supply lines and by increased activity so to reduce the supplies available to the enemy's forward troops that they could not possibly offer sustained resistance to the ground offensive. The third job, which would only begin with DIADEM, was to assist the land battle by normal close support.*

In one sense the entire interdiction campaign was indeed merely a continuation of STRANGLE; supply denial remained the sole objective and the enemy's transport network continued to be the preferred target system. But in the very process of trying to make supply denial more effective, M.A.A.F. found themselves impelled to modify the conduct of the campaign as it progressed, by diverting a portion of their effort to other types of targets in different locations. It was the unforeseen effect of these changes that turned out to be the crucial factor in the Allied success.

We saw that the damage inflicted on the enemy's rail system during STRANGLE had forced him to supplement rail movement with motor transport. This made road targets--road junctions, road bridges, and moving traffic--lucrative objects for attack, especially for fighter-bombers flying armed reconnaissance missions. In the later stages of STRANGLE and during DIADEM these targets came under increasing attack.

---

*AAF History, Vol. III, p. 386.

The other important change, partly connected with the above, was that more of the air effort was shifted from the interdiction zone north of Rome to an area closer to the front, where the lucrative road targets were located. M.A.A.F. hoped that the attacks on supply lines in the forward area shortly before intensive ground fighting was resumed would have a more immediate effect on the supply situation of the enemy's front line troops, and would create critical shortages that could not be overcome in time to meet the Allied assault.

What was not realized at the time was that the destruction of communication links in the forward zone--especially lateral links between different sectors of the front--would have a far greater and more important impact on the enemy's ability to move troops than to move supplies. The road capacity needed for troop movements is many times--maybe as much as six to eight times as great--as that needed for resupply.* Road interdiction was therefore relatively less effective in stopping supplies, and moreover supply movements were not the enemy's most critical concern. As we saw, the substantial supply cushion maintained in his forward units reduced his dependence on resupply.

The growing impairment of the enemy's mobility manifested itself in his conduct of the land battle, but obviously cannot be assessed in numerical terms. Nor is it possible to separate out the part contributed by STRANGLE. The virtual paralysis of movement which played such an important role in the German defeat was the cumulative result not only of the interdiction attacks delivered during both STRANGLE and DIADEM, but also of the effective Allied artillery fire on road targets and other objectives in the combat area.

The Effects on German Mobility

The M.A.A.F. commanders of course realized, some more than others, that the creation of supply shortages was not the only benefit of the interdiction campaign, though it remained their principal objective. They welcomed the fact that the damage inflicted on the

*J. W. Higgins, *Military Movements and Supply Lines as Comparative Interdiction Targets*, The Rand Corporation, RM-6308-PR, July 1970.

enemy's rail network and motor transport would automatically interfere with the movement of troops as well as supplies, but they welcomed it as a bonus derived from the general assault on the enemy's transport system. There is no indication that during STRANGLE attacks were specifically planned against troop movements.

After DIADEM began, however, M.A.A.F. made a deliberate effort to assist the ground offensive by attacking enemy reinforcements destined for the GUSTAV Line. Their main concern was to prevent reserves sent down from the Anzio area from reaching the main front; it was not to interfere with the mobility of the troops already there. This preoccupation with traffic coming *into* the combat area and not with movement *within* that area was what had caused them originally to place the interdiction belt well to the north of Rome. As we saw, they modified this concept in their campaign against supply when they shifted to targets in the forward zone and thereby achieved an unexpected success against the enemy's tactical mobility as well. But they retained the old concept in the attacks that were specifically aimed at enemy troop reinforcements. Yet it was the ability to move troops rapidly within the combat area that was of even greater concern to the German commanders in the field.

One of the most articulate on this subject was the Commander of the XIV Panzer Corps, General Frido von Senger und Etterlin, the "Defender of Cassino." This experienced and thoughtful officer was exceptionally well qualified to testify on the reasons why tactical mobility was so important to the German armies. In a tribute paid to him, the late British strategist, Sir Basil Liddell Hart said: "General von Senger's book is one of the most interesting memoirs of the commanders in the Second World War, and in some important respects the most illuminating of all. No other has provided such an instructive picture of battlefield conditions and the tactical problems of that war."*

---

*From the Foreword by Captain B. H. Liddell Hart in: General Frido von Senger und Etterlin, *Neither Fear nor Hope*. New York, E. P. Dutton & Co., Inc., 1964, p. 5. The book is a condensation of a voluminous manuscript General von Senger had prepared for the U.S. Army Historical Division under the title: *War Diary of the Italian*

The XIV Panzer Corps, which at times controlled as many as eight divisions,* comprised the bulk of the Tenth Army and had held a long and vital sector of the front for six months against all Allied attacks. Much of the credit for this feat, accomplished under very difficult conditions, belongs to von Senger's skillful management of his inadequate reserves. And this is why freedom of movement was such a vital necessity for him.

As he pointed out, even the more populous military powers could afford only an attenuated manning of the vast fronts of World War II. By 1944, after the enormous losses suffered in Russia and North Africa, in Sicily and in Italy, the German armies were more deficient in troop strength than the number of divisions would seem to indicate. Von Senger's divisions had an average front line infantry strength of 1200 men who had to defend a sector 6-8 kilometers wide and at least 500 meters in depth. In some of the less critical sectors, the division front was even wider. With the front so thinly defended, it was impossible to hold all points against a determined attack in strength. The alternatives were to fall back on more defensible positions in the rear--which was forbidden by Hitler's personal order that "every inch of ground must be held"--or to rush in reinforcements so as to seal off the breakthrough and regain the ground lost.

The normal procedure would have been to send in units held in corps or divisional reserve for just this purpose. But there were

---

Campaign-Cassino, MS C-095 b. Both works were based partly on the personal diaries the General kept during the war, and partly on the official War Diary of the XIV Panzer Corps.

*As mentioned earlier, there were almost daily adjustments of divisional boundaries and frequent reassignments of divisions and smaller units from one command to another. General von Senger normally commanded 6-8 divisions. He was ordered away from the front on 18 April to receive a decoration from Hitler and attend an ideological indoctrination course for senior officers. He was gone for a whole month--during the most critical time before and during DIADEM--and in his absence, Field-Marshal Kesselring took all but two of his divisions away and assigned them to different corps commands. This had the predictable effect and most of the divisions had to be restored to von Senger after he returned to the front on 17 May. There seems to have been little rapport between Kesselring and von Senger, whose anti-Nazi views were known or suspected.

no tactical reserves in the combat zone. There was only a strategic reserve of two divisions assigned to the Army Group under Kesselring's own control. They were not available as tactical reinforcements to help in local situations.* Von Senger had to improvise reserves by stripping his own front lines, when it seemed safe to do so, by holding on to parts of divisions that had been relieved and were awaiting reassignment, and by other devices. He rarely had more than a few battalions for use as corps reserve and often not even that. His division commanders followed his example but their reserves were even smaller than his.

The only way to overcome the lack of adequate reserves in case of a determined attack was to denude a temporarily quiet sector of the front and rush troops from there to the point where the danger was greatest. This meant taking the risk that if the weakened sector should also come under attack, the position would be lost. General von Senger seems to have excelled at this risky game. His skill in moving units back and forth from one place to another at the right time, and without losing their combat effectiveness, was what enabled him to hold his long front with inadequate forces.

But this had worked only so long as he was able to move units that often had no organic mobility of their own between places whose location could not be predicted in advance, and to move them rapidly enough to reverse a local setback. By the time DIADEM got under way, his freedom of movement was already impaired. The Allied interdiction attacks during STRANGLE had deprived him of motor vehicles needed for rapid movement, had destroyed bridges and blocked roads, so that it was often necessary for the units to move on foot, with their equipment carried in horse-drawn carts. After DIADEM began, the situation worsened rapidly as the access roads in the forward area were subjected to constant air attack. This made daytime movement so costly that, except in case of dire necessity, traffic was confined to the short hours of darkness. In General von Senger's own words:

---

*By the time Kesselring had released these divisions and they arrived piecemeal at the front, it was already too late to stave off defeat.

> The enemy's mastery of the air space immediately behind the front under attack was a major source of worry to the defender, for it prevented all daylight movements, especially the bringing up of reserves. We were accustomed to making all necessary movements by night, but in the event of a real breakthrough this was not good enough. That was what actually occurred in the May breakthrough. In a battle of movement a commander who can only make the tactically essential moves by night resembles a chess-player who for three of his opponent's moves has the right to only one.*

The critical importance to the enemy of tactical mobility may not have been fully appreciated in M.A.A.F. Headquarters, which remained more concerned with supplies than with troop movements. But at least one Allied air commander, though equally interested in supply denial, was fully aware how much the Germans depended on tactical mobility. Shortly after the fall of Rome, Sir John Slessor** was visited by General Marshall and General Arnold at Caserta and was asked by the latter for his views on the role airpower had played in the battle for Rome. Slessor responded with a paper on the lessons of the campaign that he prepared during Arnold's brief visit. It included a succinct statement why mobility was so important to the Germans:

> Above all, perhaps, the enemy was deprived, by the impossibility of rapid and coherent movement, of that tactical flexibility which has always been such an admirable quality in German defensive fighting--his

---

*Von Senger, *Neither Fear nor Hope*, p. 224.

**The frequent references in these pages to Air Marshal Slessor may give the impression that the author considers him the only M.A.A.F. commander whose views on interdiction are worth quoting. This is certainly not intended. It is simply that Slessor was one of the few who not only recorded his trenchant observations at the time but made them available through his Memoirs. Some of the capable U.S.A.A.F. commanders in the theater may have shared his views but did not happen to express them in easily accessible sources.

On the subject of tactical mobility, however, it seems unlikely that Slessor's recognition of its importance was widely shared by his fellow commanders. If it had been a matter of lively concern in M.A.A.F. Headquarters, one would expect it to have found its way into the contemporary M.A.A.F. accounts or the subsequent histories, where there is little or no mention of it. Nor is there any indication that it influenced the choice of interdiction targets before or during DIADEM.

> ability to pick up a battalion here, the contents of a leave train there, a machine gun *Abteilung* from one division and a couple of batteries from another, and fling them in as an improvised battle-group to save a local situation.*

The war diaries of the Tenth Army and the XIV Panzer Corps attest to the success the Allies had in blocking vital access roads that were needed for the movement of troops and supplies. During the first weeks of STRANGLE most of the reports of damage done to bridges, road junctions, and other important objectives came from the Commander of the Army Rear Area (*Korück*). The damage inflicted in the forward area during this period was attributed mainly to accurate Allied artillery fire, aided by spotter aircraft which, in the absence of effective Luftwaffe opposition, could operate unhindered over the German lines. In the last weeks of STRANGLE and all during DIADEM, however, when M.A.A.F. had begun to shift its interdiction attacks nearer to the front, there are almost daily entries in the diaries of the frantic effort to keep traffic moving in the forward area.

The problem soon became so difficult that on 15 May, the War Diary of the Tenth Army noted the appointment of a "tough" M.P. officer with motorcycle patrols to police and expedite movement on the roads. Shortly afterwards, when the front had to be withdrawn, first to the Senger position and later to the Caesar Line, the job had got out of hand and regimental commanders had to be designated as road controllers to keep traffic moving on the choked roads.

A few excerpts from the War Diary will convey the picture:**

> 16 May: "Ceaseless air attacks day and night on all access roads. Heavy fighter-bomber support for enemy ground forces..." "Ammunition situation in LI Corps is tenuous because of movement difficulties created by constant fighter-bomber attacks and destruction of roads."

---

*Slessor, p. 584. The full text of this remarkable paper is reproduced in the book (pp. 580-584). Though written immediately after the campaign, it has stood the test of time much better than some accounts written later.

**All entries are from the Daily Situation Reports of the Tenth Army under the respective dates.

17 May: "Our side is handicapped because unable to counter local break-ins or breakthroughs with reserves or troop redeployment; enemy air dominates the battlefield and attacks every movement, day and night, through bombing and strafing."

18 May: "With strongest fighter-bomber support and heaviest artillery fire, enemy immediately smashes any movement in our lines ..."
"Constant, unremitting Allied fighter-bomber activity makes movement or troop deployment almost impossible, while enemy can move his reserves freely and without hindrance ..."

22 May: "Tenth Army again suffered today from effects of enemy air supremacy. In addition to strong fighter support for enemy ground attack, large fighter-bomber and bomber formations attacked our access roads, especially where they knew our redeployments from left to right Army wing were taking place.* Attacks by 200-250 bombers effectively stopped through traffic at Avezzano... Because of air attacks no timetable for arrival of units from left to right Army wing can be made."
[This last entry was followed by another complaint about the failure of the Luftwaffe to provide air reconnaissance on enemy troop movements that would enable the commanders to anticipate the location of forthcoming attacks.]

24 May: "Holding a line has become impossible. Destruction of roads and bridges has made it difficult and occasionally impossible to bring up reserves and ammunition." [The withdrawal had begun.]

26 May: "Enemy air has further increased its systematic destruction of all access roads and paths. While heavy bomber formations are smashing important road crossings and bottlenecks, fighter-bombers maintain constant patrol over all roads. All daytime movement is paralyzed and the use of large repair crews has become impossible. Streets in Cave, Capistrello and Caroli completely blocked. One lane of Subiaco road will be made passable by nightfall. Daytime work on fortifying C-position most difficult owing to fighter-bomber attacks on work crews. Two Italian labor battalions in Subiaco area fled into hills after attacks by bombers and fighter bombers."

27 May: "Last few nights traffic virtually ceased since there are almost no detours or rerouting possibilities in the

---

*It may have appeared to the Germans that the attacks were specifically directed against their troop redeployments, and this may have been the case. But it is also possible that they were intended against supply movements.

mountains. Quick repair of destroyed roads most difficult. Italian repair crews have fled into mountains because of bombing. Corps has been ordered to use its entire M.P. complement and to appoint road commanders to supervise traffic control and repair of damaged roads."

30 May: "All divisions exhausted, especially 305th which arrived without its logistic train. Most divisions lack hot food because field kitchens not available. Despite availability of ample supplies resupply difficulties have increased since during retreat Corps is dependent on a few roads through mountains which are almost hourly blocked through incessant air attacks."

The entries in the War Diary of the XIV Panzer Corps tell a similar tale. The problems created by the destruction of roads and vehicles and the constant attacks on anything that moved were further compounded for the German commanders by the lack of prompt and accurate information on what was happening. It might take a unit days instead of hours to cover a short stretch from one sector to another and the commander seldom knew where his units were at any given time. Careful planning and strict timetables were impossible.

Moreover, on top of all their other difficulties, the Germans had to contend with severe communication problems. The headquarters of the Tenth Army was destroyed by Allied bombers at the start of DIADEM and the staff was out of contact with the front line units while it moved into the still intact headquarters of the XIV Panzer Corps. In the subsequent air attacks, the telephone system was repeatedly put out of commission. Often it was even impossible to make radio contact with the forward units so that senior commanders or their key subordinates had to make time-consuming and dangerous trips to the front to find out what was going on in the divisions.

The diary entries have given us a glimpse of the enormous problems the Germans were having with the tactical management of their forces within the combat zone: the difficulty of moving troops and their equipment from one sector of the front to another; of bringing up supplies over choked or impassable roads; of detouring around destroyed bridges or traffic choke points; the long and unpredictable delays in movement; the inability to make plans or draw up timetables for counter-action since one never knew what units would be available

or when; the shortage of skilled or even unskilled labor to repair bridges and roads; and the lack of adequate communication with forward units. Yet these and other difficulties were but incidental effects of the attacks on supply targets within the combat zone, though they were enough to tax the ingenuity of the best field commanders. But in addition, there were the effects of the attacks which the Allies carried out specifically for the purpose of interfering with the movement of reserves from the north *into* the combat zone.

As recounted earlier, Kesselring had two mobile divisions (29 Panzer Grenadier and 26 Panzer)* in Army Group reserve in the area southeast of Rome. Another reserve division which was not assigned to him was stationed in the Leghorn area: the elite Hermann Göring S.S. Parachute-Panzer Division which was rated as the most powerful division in the theater. It had been earmarked for transfer to the Western front in case of Allied invasion and was not available to Kesselring in an emergency unless specifically released to him by Hitler's OKW.

All three divisions were eventually thrown into the fray when the German front started to collapse. All were delayed, some critically so, in reaching the front lines. No doubt, Allied air action was at least a contributing factor in these delays. We know that this was the case with the Hermann Göring division, whose movement to the front is documented in sufficient detail to show what happened. There is not enough information on the redeployment of the other two divisions to say definitely what caused the delays in their arrival.

The first division to be released for combat after DIADEM was the 26 Panzer.** It was ordered out of Army Group reserve on 14 May and

---

*Both are mobile divisions. The normal TO&E for a Panzer division calls for one Panzer regiment (tanks) and two Panzer Grenadier (essentially mechanized infantry) regiments. The Panzer Grenadier division usually had three mechanized infantry regiments and one tank battalion. General von Senger, though himself an armored corps commander, preferred the Panzer Grenadier type divisions for conditions in the Italian theater.

**General von Lüttwitz, *The Employment of the 26th Panzer-Division*, MS D-312. This account by the former commander of the division only covers what happened after it arrived at the front. Except for the few facts noted below, he gives no information on the movement down to the GUSTAV Line.

transferred to the Tenth Army. Its orders were to relieve the 71 Infantry Division, which was exhausted from the bitter fighting in the GUSTAV Line, and to hold the German positions in the Pico sector against a threatened breakthrough by the French Corps. Speed was essential.

The division started out from the vicinity of Anzio, where it had been stationed, on the day it was given its marching orders, 14 May. The first unit--a mechanized infantry regiment (Panzer Grenadier)--arrived at its destination on 17 May and was followed later that day by the division staff. The rest of the division trickled in on 18 and 19 May and had to be committed to action piecemeal. At 0700 on 18 May, General von Lüttwitz took over command of the sector from the division he had relieved. But by noon of that day, only half of his own division had arrived. When it was finally complete and organized to fight as a unit, by the evening of 19 May, it was too late to retrieve the situation. The Pico position was lost on the 21st and could not be retaken.

There is no explanation why it had taken the division so long to travel what could not have been more than 60-70 miles from the Anzio area to the GUSTAV Line. It was undoubtedly slowed up by its tanks. Allied air attacks and the condition of the roads could have been other factors but are not mentioned in the division commander's account.

The next division to follow was the 29 Panzer Grenadier, which was released from Army Group reserve on 19 May and transferred to the Tenth Army. Like the 26 Panzer, it had been stationed in the area east of Anzio, which was under command of the Fourteenth Army, although both divisions, being part of the strategic reserve, were under direct control of the Commander-in-Chief, Field-Marshal Kesselring.

According to Kesselring's own sketchy account,* the commander of the Fourteenth Army, General von Mackensen, did not comply with the order transferring the 29 Panzer Grenadier out of his area to the

---

*Kesselring, *A Soldier's Record*. William Morrow & Co., New York, 1954, pp. 242-244.

GUSTAV Line, and held on to the division because he anticipated an imminent breakout from the Anzio beachhead. (It occurred four days later, on 23 May.) Kesselring did not find out about it until the evening of 20 May when he overrode his subordinate.*

We can assume, though no detailed information is available, that the 29 Panzer Grenadier left the Anzio area late on 20 May or early the next morning. It had been ordered to defend Terracina, at the southern end of the front. The direct distance it had to travel, unless detours had to be made, was probably less than 50 miles. The division arrived piecemeal, beginning on 22 May, and was immediately engaged in battle without having time to prepare proper defensive positions. It was unable to hold the line and Terracina was lost to the Allies. The division's delayed arrival may mean that it started out later than was assumed here, though it could have been due to Allied air action.**

We have a good deal more information on the movement of the Hermann Göring (H.G.) Division, which was the last of the three reserve divisions to be deployed during DIADEM.*** At Kesselring's urgent request, Hitler released the H.G. Division to him on 23 May as a reinforcement for the Fourteenth Army, which was trying to stem the Allied breakout from the Anzio beachhead.****

The division was ordered out of its bivouac area southeast of Pisa, near Leghorn, in the morning of 23 May. It was to move south by forced day and night marches to an assembly area near Valmontone,

---

*This incident undoubtedly was one of the reasons why General von Mackensen was relieved from command a few weeks later.

**It has not been possible to obtain any documentation on the movement of this division.

***Generalleutnant a. D. Wilhelm Schmalz, *Einsatz der Fallschirm-Panzerdivision "Hermann Göring" in Italien vom 26 Mai - 5 Juni 1944*, MS C-087b. The objectivity of this account is open to question.

****By 23 May, the German situation had become critical. On the main front, the Allies had breached the HITLER Line (a strongly fortified rear position behind the GUSTAV Line) and threatened an early link-up with the forces that had broken out of the Anzio beachhead, thereby cutting off the retreat of the Tenth Army.

whence it was to be deployed as a unit after all its elements had been collected. The division commander protested against having to march in daytime when he would be exposed to Allied air attack. He also pointed out that he had only enough fuel in his units to reach Viterbo, less than half the distance to his destination.* He was ordered by Kesselring's Chief of Staff to start moving forthwith, regardless of the danger of air attack. Additional fuel would be provided for him at Viterbo.

General Schmalz had no choice but to obey. The leading element of the division--a *Panzer Artillerie Abteilung* (armored artillery detachment)--started out around noon on 23 May. The rest of the division was split up among three parallel roads, along the coast, through the mountains, and the easternmost on the main road from Florence through Orvieto. The distance to Valmontone was somewhere between 200-250 miles, depending on the road taken.

When the division staff arrived at Viterbo in the morning of 24 May, it found that no fuel had been arranged for it. After lengthy palavers with Kesselring's Chief Quartermaster, the fuel was finally obtained, but the division had to use its own transport to get it out of an unfamiliar depot. The division commander states that this caused a delay of 24 hours, though without supporting this statement with any evidence.

What was more serious was that Allied recce aircraft discovered the movement of the division on the first day. From then on, in General Schmalz' words, the division was exposed to incessant low level air attack day and night. It suffered substantial losses. Out of the 80 Mk.IV tanks with which it had started out, only 11 arrived in the combat area--the rest had been either shot up or had broken down. Some were patched together by repair crews stationed along the roads and arrived piecemeal. Due to additional losses during the fighting, the division had no more than nine tanks ready for action on

---

*There was a fuel depot with reserve fuel near Florence, but it was under control of the Army Group and the division commander had no authority to draw upon it.

any day, and in the last two days before the division was put out of action, the number had been reduced to four.

The armored artillery regiment lost 18 guns during the march. Many trucks were destroyed by bombing and strafing; the division commander estimates that he lost 30 percent of his motor transport capacity, and with it a large number of machine guns, grenade throwers, and rifles. Personnel casualties were light, but it took time to replenish their weapons and equipment lost during the march.

Owing to the constant air attacks, no coherent movement was possible. The division straggled into the Valmontone area in bits and pieces and never was able to assemble or deploy as a unit. A few companies or parts of companies of one mechanized infantry regiment trickled in on the 26th, the rest followed over the next two days but had lost many of their weapons and were not ready for action for another day. Another mechanized infantry regiment arrived in similar fashion but 24 hours behind the first. The tank regiment moved in late on the 26th but was down to 11 tanks. On 26 May, the only combat-ready element of this once powerful division was the armored artillery detachment which had led the march and was sent into action as soon as it arrived. All the other division artillery, half of it shot to pieces, was still on the road.

The bulk of the division arrived over the 27th and 28th in isolated elements which were formed into improvised battle groups and sent into action as soon as they were halfway ready for combat. The battle situation had further deteriorated and the German retreat, though still orderly, threatened to become a rout. What was left of the Hermann Göring Division fought on for two or three days. By 1 June, when the division was overrun and virtually destroyed as a fighting unit, it had lost 50 percent of its personnel and was down to four Mk.IV tanks. General Schmalz states that the delays and losses imposed by Allied air action were directly responsible for the ineffective performance of this redoubtable division. They might have been avoided if Kesselring had heeded his protests against marching in daylight.

The Effects on the Operating Efficiency of the German Armies

It is self-evident that the normal operating pattern of the enemy armies was severely disrupted by the supply and movement difficulties caused by the Allied interdiction campaign, and that this must have resulted in a corresponding reduction in their fighting effectiveness. These difficulties were serious enough in themselves. But they also gave rise to new problems in unexpected areas because the air attacks caused a chain effect which sometimes spread throughout the German support system, snowballing as it went along. A notable instance of such a chain effect occurred when the damage to the rail network forced the enemy to rely more heavily on motor transport, thereby exposing the trucks to air attack, putting further pressure on the already strained supply of fuel, trucks, and spare parts, and causing M.A.A.F. to devote more effort to the road network as a target system, with unanticipated effects on German troop mobility.*

There were other, less conspicuous examples of this chain effect. Like the proverbial horseshoe nail, a minor inconvenience was sometimes transformed by circumstances into a critical degradation of the enemy's combat effectiveness. The German war diaries note many instances when the unplanned effects of an Allied air strike were more serious for them than the damage to the original objective. A few examples culled from the War Diary of the Tenth Army will show the seriousness of the problem.

Item: When the cuts in rail lines could not be repaired in time, supplies had to be unloaded and transshipped around the breaks by truck. In the case of motor fuel, which was the scarcest commodity and most urgently needed, this meant that the rail tank cars had to be unloaded into fuel drums. And as the rail cuts became more numerous, the Germans made less use of tank cars and preferred to ship the fuel

*The chain effect phenomenon was also pointed out in an earlier study of STRANGLE, in which the author mentions what he calls the "synergetic effect" resulting from the "interaction between the various elements of disruption." USAF, Assistant Chief of Staff, Studies and Analysis: *The Uncertainty of Predicting Results of an Interdiction Campaign*.

all the way in drums. This was done so that the tank cars would not have to be unloaded into drums en route, and because fuel often had to be rushed to the forward area by small coastal craft. As a result, there developed an unexpected demand for steel drums which came to be in short supply. Thus the scarcity of fuel was aggravated by the shortage of containers.

Item: During STRANGLE, railroad bridges in the area north of Rome were among the favorite targets for interdiction attacks. The commander of the Army Group Rear Area saw to it that the damaged bridges were repaired as expeditiously as possible and had assembled for this purpose all the bridge repair materials and skilled crews he could lay his hands on. This was as it should be--until the Allies started to attack bridges in the area *south* of Rome, near the front. Then it turned out that there was a lack of bridge repair materials, equipment, and crews in the forward area. Since the attacks on bridges in the northern interdiction zone continued, the rear area commander, in the immortal tradition of all armies, held on to what he needed instead of passing it on to the front. While the negotiations between the front and rear area commanders went on, the troops had to pitch in and try to repair the bridges with whatever materials they could find locally.

Item: During April, the Tenth Army was running short of barbed wire, which was badly needed to fortify the front lines and to build the CAESAR Line behind the front. The problem evidently was insoluble at the regular staff level, for the Commander of the Tenth Army himself had to bring it up in a telephone conversation with Kesselring's Chief of Staff. General von Vietinghoff (C.G., Tenth Army) was told that there was a shortage of trucks for delivery of this high volume item and that he should use his own horse-drawn transport to pick it up from the rear area. Vietinghoff protested that he had not enough carts because they were all "up north." In another telephone conversation between the two generals a few days later, Vietinghoff was assured that Kesselring's Chief Quartermaster was "worrying his head off" about the barbed wire problem. The only solution would be to

use the special motor transport express service which was strictly reserved for emergency delivery of ammunition and fuel only. Permission from the Commander-in-Chief would be necessary. Vietinghoff saw no other way out since he had been forced to tie up 750 tons of his own motor transport capacity to move the BODE Task Force,* which was costing him the capacity to unload 1-1/2 train loads.

Item: The Germans were fairly well supplied with Italian labor in the area north of Rome where the main weight of the STRANGLE effort was concentrated. But there was a labor shortage in the area south of Rome. When the Allies shifted their attacks to this area at the time of DIADEM, the Italian labor battalions took to the hills, as we have seen. Yet labor was badly needed for repair work on the roads and bridges, and to strengthen the fortifications behind the GUSTAV Line, to which the troops would have to retreat if pushed out of the front line. The Germans therefore had to use military personnel of which they were desperately short. Although they recruited this labor force from second-line troops (Slovaks and other East-European nationals who had either volunteered or preferred army service to a concentration camp), these were also needed in the front lines where they had supplied essential support services.

Item: The destruction of communications, as a result of the interdiction attacks in the forward area, added to the general disorganization of the armies. Commanders were out of touch with their units, often had to communicate by courier, could never be certain that their orders had been received or carried out, and were unable to plan movements or tactical actions with any assurance that their timetables could be met. This was crucial during the withdrawal to successive rear positions when there was always the danger that large units whose whereabouts were not precisely known might be cut off if a gap developed between adjoining units.

These are but a few examples of the many ways in which the interdiction attacks disrupted the normal functioning of a system that was

---

*An improvised battle group under the command of Colonel Bode, drawn from elements of a division based on the Adriatic Coast.

already severely strained in trying to maintain the combat effectiveness of the German armies. Even apparently trivial incidents, like the problem of getting barbed wire to the front lines, could have had serious repercussions. We do not know if the wire was obtained in time to complete the fortifications before the Allied assault. But even if it was, the fact that an army commander and the chief of staff of an army group had to deal personally with the problem means that their time and attention was diverted from other critical matters.

The wide-spread destruction caused by the STRANGLE attacks probably contributed the lion's share to the general disorganization of the German rear services, as distinct from the specific effects on enemy supplies and troop movements. The repercussions of that disorganization did not make themselves felt in the front lines until the Allied ground offensive began, but a good deal of the damage had been done earlier, during STRANGLE. The effects were, of course, magnified by the destruction inflicted in the forward area during DIADEM.

These incidental results of the interdiction campaign should not be discounted merely because they cannot be planned for and because their impact on the German armies is impossible to assess. The enemy commanders could enlarge on such specific and crippling effects as the loss of tactical mobility, but they themselves would be unable to say how much the fighting effectiveness of their troops was reduced by the innumerable small or large problems created for them through the side effects of the Allied air attacks. That it was so reduced is apparent from their own accounts. How much each of the different effects of the interdiction campaign contributed to the growing degradation of combat effectiveness and to the eventual defeat of the German armies is impossible to say. But the general disruption of the enemy's normal operating patterns played its part, and it was not a negligible one.

The issue was again well summed up by Air Marshal Slessor in his paper on the results of the interdiction campaign:

> Lord Trenchard has said that all land battles are confusion and muddle, and the job of the Air is to accentuate that confusion and muddle in the enemy's Army to a point when it gets beyond the capacity of anyone to control. This is exactly what the Air

> did to the German Army in Italy during the critical last days of May and first days of June.*

Slessor's somewhat ambiguous reference to the final days of the battle should not be misread. He did not mean that it was only the air effort during the last few days that had produced these effects. He was referring to the cumulative results of the entire interdiction campaign that began with STRANGLE and reached its apex during DIADEM.

Both phases of the campaign played a part in the defeat of the German armies. As the study has shown, however, the contribution that airpower made during the STRANGLE phase, though by no means inconsiderable, was less effective than what was achieved during the DIADEM phase. It was during this latter stage that fortuitous changes in the conduct of the air effort resulted in the paralysis of the enemy's tactical mobility, which had not been planned for but proved to be the most valuable pay-off from the Italian interdiction campaign.

---

*Slessor, p. 583.

Appendix A

GERMAN RECORDS ON SUPPLY AND CONSUMPTION OF AMMUNITION AND FUEL IN THE TENTH AND FOURTEENTH ARMY DURING STRANGLE AND DIADEM

Table 2

SUPPLY AND CONSUMPTION OF FUEL AND AMMUNITION IN TENTH ARMY
(15 March - 1 June 1944)

WORKSHEET	10th GERMAN ARMY AUTO FUEL SUPPLY (metric tons)(a)			CONSUMPTION (tons)	10th GERMAN ARMY DIESEL FUEL SUPPLY (metric tons)(b)			CONSUMPTION (tons)	10th GERMAN ARMY AMMUNITION SUPPLY (tons)(c)			CONSUMPTION (tons)
	UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL	
1944 MARCH 15	2107.6	292.0	2399.6	168.0	542.8	186.8	729.6	56.8	7511	9350	16,861	120
16	2067.6	331.7	2399.5	140.0	519.3	163.4	702.7	55.8	7511	9354	16,865	180
17	2039.5	237.2	2276.7	132.3	536.6	112.3	655.9	56.8	7957	9218	17,175	235
18	2024.6	580.7	2605.3	132.3	524.4	211.1	735.5	46.6	7796	9415	17,214	320
19	1942.6	424.7	2367.3	126.6	514.3	188.5	702.8	46.6	7635	9635	17,000	290
20	1934.6	306.8	2241.4	128.6	505.9	173.4	679.3	50.8	7716	9706	17,422	240
21	1889.2	410.0	2299.2	126.6	536.6	122.3	660.9	50.8	7555	10,068	17,623	250
22	1955.1	625.1	2660.2	168.0	577.1	136.5	713.6	50.8	7555	10,084	17,639	300
23	1696.5	691.3	2587.8	154.4	561.2	102.2	663.4	55.8	7727	10,214	17,941	300
24	1825.2	665.6	2540.8	168.0	564.6	55.3	619.9	46.6	7609	10,216	18,025	280
25	1845.2	646.6	2491.8	154.4	550.3	68.7	619.0	63.5	7690	10,062	17,952	300
26	2001.2	659.0	2660.2	154.4	575.5	147.4	722.9	59.3	8053	9672	17,925	270
27	2017.3	656.8	2674.1	168.0	568.8	144.1	712.9	50.8	7999	9732	17,731	270
28	1921.4	585.8	2507.2	161.7	541.1	114.8	655.9	52.3	7999	9504	17,503	250
29	1890.6	462.8	2353.4	154.4	515.2	82.9	598.1	59.3	7918	9772	17,690	250
30	1824.5	390.2	2204.7	168.0	519.3	46.1	565.4	59.3	7838	9434	17,272	255
31	1884.0	352.9	2236.9	132.3	512.6	54.4	567.0	50.8	7838	9513	17,351	240
1944 APRIL 1	1656.9	251.9	2108.8	132.3	472.2	31.0	530.2	50.8	7838	9683	17,521	200
2	1842.3	251.9	2094.2	132.3	486.7	24.3	511.0	38.1	7626	9527	17,153	180
3	1856.2	262.1	2118.3	132.3	514.7	29.3	543.6	38.1	7626	9362	16,988	170
4	1806.4	451.8	2258.2	132.3	503.4	69.5	572.9	38.1	7783	9116	16,899	160
5	1802.0	436.4	2238.4	168.0	496.4	170.0	666.4	50.8	7862	9034	16,896	130
6	1802.0	303.9	2105.9	161.7	519.3	96.3	615.6	50.8	7940	8937	16,877	120
7	1798.4	302.4	2100.8	168.0	462.5	76.2	563.7	55.8	8098	8947	17,045	130
8	1865.0	260.7	2125.7	161.7	483.5	30.5	523.8	42.3	8098	9022	17,120	110
9	1826.9	214.5	2041.4	154.4	462.5	54.4	541.9	42.3	8334	8801	17,135	110
10	1759.6	125.0	1884.6	168.0	426.6	41.0	517.6	33.9	8334	9223	17,557	110
11	1770.5	131.8	1902.3	168.0	461.6	28.5	490.1	42.3	8334	9156	17,490	120
12	1963.8	127.4	2091.2	143.4	480.0	51.1	531.1	42.3	8412	9008	17,420	120
13	1889.2	142.1	2031.3	143.4	461.6	41.9	503.5	42.3	8412	8974	17,386	120
14	1877.4	243.8	2121.2	143.4	451.5	106.4	557.9	38.1	8491	9074	17,565	110
15	1869.4	459.1	2328.5	140.0	446.5	150.8	597.3	38.1	8570	9267	17,837	110
16	1925.5	363.2	2288.7	140.0	457.4	210.3	667.7	38.1	8570	9197	17,767	120
17	1903.1	518.4	2421.5	168.0	458.2	189.3	647.5	42.3	8570	9079	17,649	120
18	1940.4	595.3	2535.7	168.0	456.8	151.6	608.4	42.3	8570	9007	17,577	130
19	1925.6	552.1	2527.7	143.4	462.4	123.1	585.5	50.0	8648	9151	17,799	130
20	2038.9	483.7	2522.6	168.0	552.0	38.5	590.5	50.8	8727	9248	17,975	110
21	2154.2	409.3	2563.5	140.0	542.8	37.7	585.5	50.8	8648	9121	17,769	120
22	2094.2	446.1	2540.3	168.0	523.5	24.3	547.8	42.3	8648	9084	17,732	110
23	2094.9	322.2	2417.1	143.4	538.6	19.3	557.9	42.3	8648	9061	17,709	130

For footnotes, see next page.

Table 2 -- Continued

WORKSHEET 18 (3-80)		10th GERMAN ARMY AUTO FUEL SUPPLY (METRIC TONS) (a)			CONSUMPTION (TONS)	10th GERMAN ARMY DIESEL FUEL SUPPLY (IMPERIAL TONS) (b)			CONSUMPTION (TONS)	10th GERMAN ARMY AMMUNITION SUPPLY (TONS) (C)			CONSUMPTION (TONS)
		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL	
	24	2031.2	259.2	2290.4	132.3	515.2	51.9	567.1	29.6	8727	9060	17,787	130
	25	2036.1	330.2	2366.3	132.3	510.1	70.4	580.5	29.6	8828	8789	17,617	120
	26	2046.6	189.6	2236.2	136.0	499.2	52.8	552.0	29.6	8749	8520	17,269	120
	27	1685.6	238.7	1924.3	136.0	414.6	72.9	487.5	29.6	8582	8431	17,013	130
	28	1606.5	358.8	1965.3	140.0	392.0	63.7	455.7	33.9	8654	8552	17,206	120
	29	1649.7	411.5	2061.2	140.0	426.4	55.3	481.7	33.9	8562	8566	17,168	120
	30	1614.6	311.9	1926.5	148.0	401.2	101.4	502.6	33.9	8654	8414	17,068	130
1944 MAY	1	—	—	—	143.4	—	—	—	38.1	—	—	—	120
	2	1612.4	241.6	1854.0	140.0	405.4	37.7	443.1	12.0	9087	8229	17,316	120
	3	1950.0	128.1	2078.1	140.0	398.7	72.9	471.6	33.9	9231	7942	17,173	120
	4	1397.8	128.9	1526.7	132.3	401.2	78.7	479.9	33.9	9087	8086	17,173	120
	5	1304.1	96.7	1400.8	140.0	402.1	44.4	451.5	33.9	9485	7980	17,465	120
	6	—	—	—	125.0	—	—	—	33.9	9412	8148	17,560	120
	7	1210.4	35.1	1245.5	136.0	388.7	31.8	420.5	38.1	9559	8152	17,711	110
	8	1192.1	61.5	1253.6	136.0	365.3	62.0	452.9	33.9	9632	8420	18,052	120
	9	1259.4	69.6	1329.0	132.3	444.8	52.6	501.8	38.1	9776	8303	18,079	120
	10	1246.3	37.3	1283.6	132.3	451.5	49.4	500.9	38.1	9998	8242	18,240	105
	11	1192.2	102.5	1294.7	148.0	419.7	89.6	509.3	42.3	9998	8104	18,102	120
	12	1132.6	139.9	1272.7	148.0	412.1	102.2	514.3	42.3	—	8307	—	425
	13	1105.7	142.1	1247.8	154.4	422.2	104.7	526.9	42.3	9850	8337	18,187	450
	14	1100.5	164.0	1264.5	143.4	405.4	92.1	497.5	42.3	9702	8327	18029	600
	15	1136.9	155.2	1282.1	150.7	402.1	75.4	482.5	46.6	9258	8071	17,329	750
	16	1094.7	147.2	1241.9	154.4	393.7	172.6	566.3	46.6	8813	7909	16,722	650
	17	1176.9	101.0	1279.9	176.4	405.4	185.1	590.5	59.3	9163	7301	16,464	560
	18	1153.3	206.5	1359.8	198.6	416.6	169.2	585.8	59.3	9433	7523	16,956	550
	19	1122.5	331.7	1454.2	220.8	438.1	227.5	665.9	59.3	9351	7214	16,565	700
	20	1436.6	382.2	1818.8	225.0	480.8	284.8	765.6	67.8	9105	7194	16,299	600
	21	1186.9	385.9	1572.8	330.9	448.8	237.1	686.9	84.7	8941	7502	16,443	550
	22	1367.6	201.4	1569.2	308.9	430.6	191.8	622.4	76.2	9023	7571	16,594	550
	23	1340.0	134.7	1474.7	213.2	423.9	157.5	581.4	59.3	9856	7317	17,173	600
	24	1235.3	188.9	1424.2	242.6	449.8	113.1	562.9	59.3	9764	7217	16,981	500
	25	1158.4	98.9	1257.3	335.3	428.0	63.7	491.7	59.3	9777	7277	17,054	500
	26	1141.5	111.3	1252.8	245.0	430.6	72.9	503.5	67.8	9302	7194	16,496	550
	27	1039.0	56.4	1095.4	235.3	416.3	65.3	481.6	67.8	—	—	—	500
	28	936.5	78.3	1014.8	235.3	405.4	88.8	494.2	67.8	9587	6912	16,499	450
	29	925.5	164.0	1089.5	220.6	408.8	130.7	539.5	59.3	9587	7056	16,643	450
	30	905.0	85.7	990.7	220.6	421.3	113.9	535.2	67.8	9360	8200	17,560	450
	31	826.7	83.5	910.2	205.8	356.8	139.9	496.7	59.3	—	—	—	450
1944 JUNE	1	—	—	—	213.2	—	—	—	59.3	—	—	—	400

[a]Converted from cubic meters at factor of 1 cbm = .73223 tons.

[b]Converted from cubic meters at factor of 1 cbm = .83766 tons.

[c]Type of ton not specified in source. Assumed to be metric tons.

Source: "Data Bank" on Operation STRANGLE, maintained in Hq. USAF (AF/SAG). Based on German Quartermaster Records.

Table 3

SUPPLY AND CONSUMPTION OF FUEL AND AMMUNITION IN FOURTEENTH ARMY
(15 March - 1 June 1944)

WORKSHEET	14th GERMAN ARMY AUTO FUEL SUPPLY (metric tons) (a)			CONSUMPTION (tons)	14th GERMAN ARMY DIESEL FUEL SUPPLY (metric tons) (b)			CONSUMPTION (tons)	14th GERMAN ARMY AMMUNITION SUPPLY (tons) (c)			CONSUMPTION (tons)
	UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL	
1944 MARCH 15	2203.3	485.4	2688.7	183.8	586.4	96.7	683.1	44.1	11,471	4381	15,852	350
16	2325.6	52.1	2362.7	190.4	520.4	23.7	644.1	44.1	11,692	4767	16,459	240
17	2289.0	319.2	2608.2	166.4	614.0	62.3	676.3	41.5	11,885	4877	16,762	275
18	2366.6	552.0	2918.6	187.5	623.2	152.5	780.7	50.0	12,233	4399	16,632	260
19	2559.9	515.8	3075.7	194.9	671.0	136.3	807.3	39.8	12,208	3811	16,019	351
20	2600.1	423.1	3023.2	176.4	700.3	112.4	812.7	41.5	12,436	3910	16,346	255
21	2507.9	526.7	3034.6	176.4	727.1	191.6	918.7	48.3	12,817	3493	16,310	260
22	2735.6	30.0	2765.6	169.1	774.0	42.6	816.6	41.5	13,480	3323	16,803	260
23	2544.5	48.8	2593.3	181.6	739.8	112.3	851.1	36.4	14,196	3039	17,235	322
24	2354.9	53.2	2408.1	192.6	691.9	109.1	801.0	40.6	14,154	2997	17,151	244
25	2176.9	40.7	2217.6	191.2	647.5	102.8	750.3	37.2	14,536	3597	18,133	338
26	2165.2	149.1	2314.3	188.8	646.3	144.9	793.2	40.7	14,169	3762	17,931	213
27	2163.7	118.4	2282.1	172.8	657.6	158.5	816.1	38.1	13,951	3615	17,566	394
28	2026.1	193.2	2219.3	110.3	630.8	130.5	761.3	38.9	14,108	3483	17,591	277
29	1853.3	282.3	2140.6	185.2	591.4	165.7	757.1	38.1	14,349	3762	18,111	264
30	1924.3	25.4	1999.7	—	590.6	91.0	681.6	—	14,691	3937	18,628	—
31	1908.2	142.0	2051.2	—	586.4	73.8	660.2	—	14,669	3943	18,588	—
1944 APRIL 1	1928.7	148.5	2077.2	170.6	578.8	65.2	644.0	33.0	14,544	3908	18,452	188
2	2095.6	321.5	2412.1	163.2	555.4	145.5	700.9	35.6	14,199	3821	18,020	276
3	2109.6	156.5	2266.1	152.3	709.5	87.2	796.7	31.3	13,929	4313	18,256	185
4	2023.9	362.9	2386.8	161.0	675.2	110.3	785.5	47.4	14,257	4441	18,698	304
5	1948.5	326.7	2275.2	158.8	643.3	134.0	777.3	31.3	14,485	3987	18,472	247
6	2074.4	547.9	2622.3	146.3	629.9	176.7	806.6	45.7	14,580	3463	18,043	250
7	2201.7	683.4	2885.1	177.2	650.9	155.5	806.7	44.1	14,353	3561	17,914	341
8	2092.5	539.6	2632.4	141.9	603.1	125.4	728.5	35.6	14,195	3747	17,942	324
9	1977.0	487.2	2464.2	139.7	567.9	123.0	690.9	41.5	14,294	4066	18,360	316
10	2086.1	657.3	2743.4	145.5	652.6	116.6	769.2	32.1	14,287	4029	18,316	161
11	2397.3	855.3	3252.6	145.5	752.2	98.7	850.9	32.3	14,351	4359	18,710	171
12	2579.6	653.2	3232.8	161.0	775.7	129.3	905.0	28.8	15,179	4422	19,601	156
13	2550.4	834.4	3384.8	163.9	756.4	113.1	869.5	45.7	15,393	4828	20,221	254
14	2893.7	334.0	3162.7	156.6	767.3	34.6	801.9	48.3	15,301	4849	20,150	172
15	2721.7	262.6	2998.5	150.0	729.6	79.4	809.0	43.2	15,282	4989	20,271	168
16	2914.3	111.1	3025.4	158.0	712.0	64.4	776.4	44.1	15,160	4801	19,961	231
17	2775.9	117.4	2893.3	153.6	748.0	46.7	794.7	48.3	16,057	3831	19,888	263
18	2782.6	60.9	2843.5	145.6	717.9	29.7	747.6	43.2	16,132	4067	20,199	223
19	2721.7	63.8	2785.5	146.3	682.7	56.2	738.9	40.6	16,353	4617	20,970	219
20	2822.7	225.0	3047.7	148.5	746.4	113.7	860.1	39.8	16,124	4685	20,659	152
21	2982.4	74.6	3057.0	153.6	744.7	66.7	811.4	44.1	16,249	4982	21,231	201
22	2969.3	63.0	3032.9	135.3	769.0	22.0	791.0	38.1	16,121	4882	21,003	279
23	2683.5	31.0	2914.5	139.7	744.7	23.0	767.7	40.0	15,827	4325	20,153	363

For footnotes, see next page.

Table 3 -- Continued

WORKSHEET 18 (2-50)		14th GERMAN ARMY AUTO FUEL SUPPLY (metric tons)(a)			CONSUMPTION (tons)	14th GERMAN ARMY DIESEL FUEL SUPPLY (metric tons)(b)			CONSUMPTION (tons)	14th GERMAN ARMY AMMUNITION SUPPLY (tons)(c)			CONSUMPTION (tons)
		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL		UNITS	DEPOTS	TOTAL	
	24	2929.7	23.0	2952.7	153.6	724.6	59.0	783.6	38.1	15,715	3859	19,574	66
	25	3117.8	126.0	3245.8	146.3	779.7	22.0	801.7	39.6	15,506	4173	19,679	237
	26	3311.1	70.0	3381.1	150.7	784.0	24.0	808.0	38.1	15,503	4290	19,793	202
	27	3188.1	21.0	3209.1	142.4	745.5	11.0	756.5	42.4	15,992	3582	19,821	336
	28	3104.7	272.0	3376.7	164.7	748.0	41.0	789.0	50.0	15,586	3563	19,147	164
	29	3053.4	363.0	3416.4	156.6	707.0	173.0	880.0	48.3	15,447	3597	19,044	191
	30	3160.3	251.0	3411.3	150.0	698.6	135.0	833.6	44.9	15,607	3524	19,001	211
1944 MAY	1	—	380.0	—	142.6	—	130.0	—	39.0	—	—	—	147
	2	3390.3	254.0	3584.3	153.7	707.0	112.0	819.0	44.9	15,321	3549	18,870	164
	3	3364.6	145.0	3509.6	168.4	696.1	102.0	803.1	47.4	15,710	3472	19,182	188
	4	3296.5	53.0	3349.5	149.2	750.5	94.0	844.5	41.5	15,714	3447	19,161	181
	5	3146.4	65.0	3211.4	149.2	745.5	92.0	837.5	40.6	15,714	3511	19,225	141
	6	3228.4	333.0	3561.4	156.6	725.4	178.0	903.4	44.9	15,535	3402	18,937	249
	7	3272.3	224.0	3496.3	161.7	692.7	83.0	775.7	48.3	15,612	3368	18,980	134
	8	3260.6	149.0	3409.6	175.7	698.6	24.0	722.6	44.1	15,490	3383	18,873	165
	9	3637.7	307.0	3944.7	166.9	754.7	139.0	893.7	47.4	15,512	3318	18,830	122
	10	3505.2	223.0	3728.2	152.3	738.0	99.0	837.0	48.3	15,454	3933	19,387	232
	11	3393.2	221.0	3614.2	154.4	723.7	100.0	823.7	39.8	15,389	3965	19,354	147
	12	3344.8	193.0	3537.8	161.7	737.1	89.0	826.1	39.6	15,433	4099	19,532	116
	13	3328.7	92.0	3420.7	151.4	736.5	77.0	811.5	35.6	15,810	3608	19,418	104
	14	3078.3	120.0	3198.3	145.5	799.1	113.0	912.1	39.0	15,690	4541	20,231	138
	15	3185.2	109.0	3294.2	132.3	763.1	112.0	875.1	42.4	14,925	4557	19,480	105
	16	3120.0	118.0	3238.0	149.2	732.1	112.0	844.1	35.6	14,908	4567	19,475	105
	17	3062.2	91.0	3153.2	132.3	762.3	119.0	886.3	34.7	15,215	4438	19,653	118
	18	3036.6	139.0	3175.6	155.1	723.2	153.0	926.2	34.7	15,403	4255	19,658	98
	19	2564.3	88.0	2652.3	140.4	733.8	126.0	859.8	32.2	15,363	4106	19,491	74
	20	2236.2	101.0	2337.2	132.3	687.7	119.0	806.7	32.3	13,912	3857	17,769	65
	21	1975.6	25.0	2050.6	191.1	626.2	109.0	737.2	54.2	14,350	3725	18,075	103
	22	1895.7	38.0	1933.7	105.9	601.4	112.0	713.4	30.5	12,665	3919	16,584	122
	23	1790.3	53.0	1843.3	105.1	623.2	95.0	718.2	33.0	12,521	4055	16,576	361
	24	1720.7	41.0	1761.7	72.0	640.8	92.0	732.8	44.4	11,718	3899	15,617	566
	25	1628.5	18.0	1646.5	200.7	603.1	98.0	701.1	54.2	11,338	3643	15,041	539
	26	1547.2	3.0	1549.2	121.3	644.2	65.0	709.2	59.6	10,581	3732	14,313	428
	27	1462.4	51.0	1513.4	31.1	594.7	48.0	642.7	42.4	10,432	3666	14,127	150
	28	1542.9	141.0	1683.9	100.7	584.7	24.0	608.7	33.9	9930	3675	13,605	505
	29	1423.5	139.0	1562.5	147.6	566.3	36.0	602.3	50.8	9684	3643	13,327	600
	30	1419.1	108.0	1522.1	177.9	536.3	22.0	558.3	54.2	9641	3344	12,985	838
	31	1374.4	169.0	1543.4	200.7	513.5	55.0	568.5	56.8	9440	3612	13,052	826
1944 JUNE	1	—	—	—	406.0	—	—	—	61.0	—	—	—	160

[a]Converted from cubic meters at factor of 1 cbm = .73223 tons.

[b]Converted from cubic meters at factor of 1 cbm = .83766 tons.

[c]Type of ton not specified in source. Assumed to be metric tons.

Source: "Data Bank" on Operation STRANGLE, maintained in Hq. USAF (AF/SAG). Based on German Quartermaster Records.

Table 4

DAILY STATUS REPORT OF AMMUNITION IN TENTH ARMY AS OF 1 APRIL 1944
(Stocks held in Divisions and Corps Depots)

1 April 1944

Encl 18 S 2 to War Diary #6 of 10 Army Headquarters

Department: Ammunition

Supply in units by type of weapon Required (R) / Actual (A) in metric tons, as of 1 April 1944

		1 Para Div.	71 Inf. Div.	15 Pz. Gren.	94 Inf. Div.	44 Inf. Div.	5 Mt. Div.	414 Corps Art'y.	305 Inf. Div.	334 Inf. Div.	Task Force Bode	114 Lt. Div.	90 Pz. Gren.	XIV Panzer Corps	LI Mountain Corps
Machine Gun	R	1.8	2.1	1.4	1.2	1.4	1.3	--	2.4	1.2	2.1	0.8	1.0	52	59
	A	1.8	2.1	1.5	1.2	1.4	1.3	--	2.5	1.6	2.1	1.0	1.0		
8 cm Grenade Thrower	R	0.6	1.3	1.8	1.0	1.0	1.0	--	0.8	0.9	1.4	0.7	0.5	21	49
	A	0.3	1.4	1.0	1.7	0.8	1.1	--	0.6	0.6	0.8	0.9	0.7		
12 cm Grenade Thrower	R	--	1.0	--	0.5	1.1	0.4	--	--	0.8	--	--	--	22	8
	A	--	1.0	--	0.5	1.1	0.5	--	--	2.4	--	--	--		
Light Inf. Gun 18	R	--	1.4	1.3	0.7	1.4	0.7	--	1.0	1.4	1.3	1.0	1.9	41	52
	A	--	1.1	1.3	2.1	2.1	1.0	--	1.3	1.1	0.7	1.4	2.7		
Heavy Inf. Gun 33	R	--	2.6	2.9	1.0	2.9	0.5	--	1.2	1.0	2.1	0.7	1.5	50	186
	A	--	3.1	2.9	2.4	2.7	0.7	--	2.4	1.0	2.1	0.7	1.1		
Light Field Howitzer 18	R	1.4	1.0	1.5	0.9	1.0	--	--	0.8	0.6	1.0	0.6	0.9	167	164
	A	1.5	1.5	1.8	1.1	1.1	--	--	0.7	0.8	1.4	0.7	1.0		
Heavy Field Howitzer 18	R	0.8	1.8	1.7	0.9	0.7	0.5	--	1.3	0.9	--	--	--	55	71
	A	0.9	1.8	1.7	1.2	0.7	0.7	--	1.9	1.2	--	--	--		
Heavy 10 cm Cannon 18	R	0.9	--	1.1	--	--	0.2	--	--	--	--	--	--	26	--
	A	0.9	--	1.1	--	--	0.4	--	--	--	--	--	--		
21 cm Mortar	R	--	--	--	--	--	--	1.6	--	--	--	--	--	--	--
	A	--	--	--	--	--	--	2.4	--	--	--	--	--		
17 cm Cannon	R	--	--	--	--	--	--	0.2	--	--	--	--	--	9	--
	A	--	--	--	--	--	--	0.3	--	--	--	--	--		
15 cm Mult. Rckt Launcher	R	5.8	--	--	--	--	--	0.8	--	--	--	--	--	82	--
	A	5.8	--	--	--	--	--	0.8	--	--	--	--	--		
21 cm Mult. Rckt Launcher	R	--	--	--	--	--	--	0.9	--	--	--	--	--	40	--
	A	--	--	--	--	--	--	0.9	--	--	--	--	--		
Mountain Gun 36	R	--	--	--	--	--	1.9					0.9		--	--
	A	--	--	--	--	--	1.9	--	--	--	--	1.3	--		
Mountain Howitzer 40	R	--	--	--	--	--	1.2	--	--	--	--	1.1	--	--	--
	A	--	--	--	--	--	1.6	--	--	--	--	1.1	--		
22 cm Mortar (F)	R	--	--	--	--	--	0.5	--	--	--	--	--	--	21	--
	A	--	--	--	--	--	0.8	--	--	--	--	--	--		
3.7 cm Flak	R	--	--	--	--	--	0.1	--	--	--	--	--	--	--	--
	A	--	--	--	--	--	0.1	--	--	--	--	--	--		

Supply in Corps Depots

The Corps depots contain the following quantities which are not counted as original unit equipment and are regarded as Corps reserve (metric tons)

Table 4 -- Continued

(Ammunition Stocks in Army Depots--Metric Tons)

	"MALI"				"MAULWURF"				"MANFRED"				"MARTIN"				"MOTTE"			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Inf. Ammo			31	37			43	47			231	231			5.3	5.3			91	91
8 cm Gren. Thrower	30		36	41			6.5	18			20	20							8	20
12 cm Gren. Thrower			8	11.0			30	30			42	42							25	45
Lt. Inf. Gun 18			16	18		4.7	47	81			36	36							29	29
Hvy. Inf. Gun 33			66	66			28	28			50	50							166	166
Lt. Field How. 18	44		46	46			33	55				10							34	75
Hvy. Field How. 18	100		100	140			90	93							2	15			55	59
Hvy. 10 cm Cannon			13	31			2.5	2.5			4	4.5								
21 cm Mortar 18			1	2			12	21			16	16								
17 cm Cannon							21	90												
15 cm Multiple Rocket Launcher		25	123	183			183	229			30	30								
21 cm Multiple Rocket Launcher				43			29	40							15	30			75	75
3.7 cm Flak											1	1								
Mount. Gun 36			43	53											96	96				
Mount. Gun 40				3		1	1	2			59	73			26	35			2.6	2.6
22 cm Mortar (F)			4	23			82	82							7.1	7.1			16	16

1 - In
2 - Out
3 - Ready for issue after accounting for 1 and 2
4 - Depot stock level

Table 5

DAILY STATUS REPORT OF AMMUNITION IN TENTH ARMY AS OF 20 APRIL 1944
(Stocks held in Divisions and Corps Depots)

20 April 1944

Encl 332 S 2 to War Diary #6 of 10 Army Headquarters

Department: Ammunition

Supply in units by type of weapon Required (R) / Actual (A) in metric tons, as of 20 April 1944

		1 Para Div.	71 Inf. Div.	15 Pz. Gren.	94 Inf. Div.	44 Inf. Div.	5 Mt. Div.	414 Corps Art'y.	305 Inf. Div.	334 Inf. Div.	114 Lt. Div.	90 Pz. Gren.
Machine Gun	R	1.8	2.3	1.4	1.9	1.4	1.5	--	1.9	1.1	1.7	0.9
	A	1.8	2.3	1.5	1.9	1.4	1.5	--	1.9	1.4	2.2	0.9
8 cm Grenade Thrower	R	1.2	1.0	1.2	1.4	0.6	0.7	--	1.1	1.0	1.4	0.7
	A	0.7	0.7	0.7	1.1	0.8	0.6	--	0.8	0.5	1.7	0.9
12 cm Grenade Thrower	R	--	1.3	--	1.0	0.2	0.7	--	0.8	0.7	--	--
	A	--	1.3	--	1.3	0.2	1.1	--	3.2	2.1	--	--
Light Inf. Gun 18	R	--	1.2	1.3	1.1	1.3	0.9	--	1.1	1.4	1.6	1.7
	A	--	0.8	1.2	1.2	3.2	1.2	--	0.9	1.3	1.8	2.4
Heavy Inf. Gun 33	R	--	1.9	2.9	1.6	1.0	0.9	--	1.6	1.1	2.0	1.3
	A	--	1.9	2.9	2.4	2.0	1.2	--	3.2	1.1	2.0	1.0
Light Field Howitzer 18	R	1.0	0.9	1.2	1.2	0.9	--	--	1.3	0.9	1.1	0.9
	A	0.9	1.2	1.5	1.4	1.2	--	--	1.2	1.1	1.2	1.0
Heavy Field Howitzer 18	R	1.6	2.0	2.0	0.6	1.4	1.3	--	1.2	0.9	--	--
	A	1.6	2.6	2.0	1.0	1.8	1.7	--	1.8	1.2	--	--
Heavy 10 cm Cannon 18	R	1.1	--	1.3	--	--	0.7	--	--	--	--	--
	A	1.1	--	1.3	--	--	0.7	--	--	--	--	--
21 cm Mortar	R	--	--	--	--	--	--	0.8	--	--	--	--
	A	--	--	--	--	--	--	0.8	--	--	--	--
17 cm Cannon	R	--	--	--	--	--	--	0.9	--	--	--	--
	A	--	--	--	--	--	--	0.9	--	--	--	--
15 cm Mult. Rckt Launcher	R	3.4	--	--	--	--	--	1.1	--	--	--	--
	A	3.4	--	--	--	--	--	1.1	--	--	--	--
21 cm Mult. Rckt Launcher	R	--	--	--	--	--	--	1.3	--	--	--	--
	A	--	--	--	--	--	--	1.3	--	--	--	--
Mountain Gun 36	R	--	--	--	--	--	1.6	--	--	--	0.9	--
	A	--	--	--	--	--	1.6	--	--	--	1.3	--
Mountain Howitzer 40	R	--	--	--	--	--	1.3	--	--	--	1.0	--
	A	--	--	--	--	--	1.7	--	--	--	1.0	--
22 cm Mortar (F)	R	--	--	--	--	--	0.8	--	--	--	--	--
	A	--	--	--	--	--	1.2	--	--	--	--	--
3.7 cm Flak	R	--	--	0.3	--	--	0.8	--	--	0.2	--	--
	A	--	--	0.3	--	--	0.8	--	--	0.2	--	--

Supply in Corps Depots

The Corps depots contain the following quantities which are not counted as original unit equipment and are regarded as Corps reserve (metric tons)

XIV Panzer Corps	LI Mountain Corps
10	73
23	59
22	14
34	52
33	139
158	71
82	82
14	--
--	--
9	--
61	--
--	--
--	--
--	--
--	--
--	--

Table 5 -- Continued

(Ammunition Stocks in Army Depots--Metric Tons)

	"MALI"				"MAULWURF"[a]				"MANFRED"				"MARTIN"				"MOTTE"				"MAGNET"			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Inf. Ammo			70	72			2	3			164	164			1.4	2.4			39	60			4.9	4.9
8 cm Gren. Thrower			50	60			5.5	11[b]			12	14							12	14				
12 cm Gren. Thrower			17	19				2			32	32							13	25				
Lt. Inf. Gun 18	45		57	62				4			16	22								7				
Hvy. Inf. Gun 33			63	63							48	48							109	127				
Lt. Field How. 18	124		304	360			5	17			38	56		25		25			13	14			14	25
Hvy. Field How. 18	36		223	236												14				49				50
Hvy. 10 cm Cannon			93	107																				
21 cm Mortar 18			18	34							7	7												
17 cm Cannon			15	15															18	62				33
15 cm Multiple Rocket Launcher			170	180			57	98[c]			30	30							40	40			18	52
21 cm Multiple Rocket Launcher			17	17				13							15	15			85	107				
3.7 cm Flak			4.5	4.5							1	1												
Mount. Gun 36			38	38											73	73								
Mount. Gun 40	24		24	24			1	1			58	58			11	11			2.6	2.6				
22 cm Mortar (F)								20								7.1			9	16				

[a]The Depot "MAULWURF" was partially destroyed by Allied bombers early in April.

[b]Stored in "Maria".

[c]Of which 15 tons in "Maria".

1 - In
2 - Out
3 - Ready for issue after accounting for 1 and 2
4 - Depot stock level

Appendix B

BIBLIOGRAPHY

THE ALLIED SIDE

Official Accounts

W. F. Craven and J. L. Cate (eds.), *The Army Air Forces in World War II*, Vol. 3, *Europe: Argument to V-E Day (January 1944 to May 1945)*, The University of Chicago Press, Chicago, 1951.

Headquarters, Mediterranean Allied Air Forces, *Mediterranean Allied Air Forces Operations in Support of DIADEM*, Vols. I to VII, 1944.

_____, *"STRANGLE" and "DIADEM,"* 1944. A condensed version of the narrative portions of the above report; cited as "Narrative."

Historical Division, U.S. War Department, *Salerno, Volturno, The Winter Line, Anzio Beachhead.* A series of brief campaign accounts, with maps, issued during the war in the "American Forces in Action Series."

U.S. Military Academy, *Operations in Sicily and Italy*, West Point, N.Y., 1947.

Lt. Col. Chester J. Starr (ed.), *From Salerno to the Alps--A History of the Fifth Army, 1943-1945*, Infantry Journal Press, Washington, D.C., 1948.

John Ehrman, *Grand Strategy*, Vol. V, *August 1943 - September 1944*, in *History of the Second World War*, United Kingdom Military Series, Her Majesty's Stationary Office, London, 1956.

Denis Richards and Hilary St. George Saunders, *Royal Air Force 1939-1945*, Vol. II, Her Majesty's Stationary Office, London, 1954.

Campaign Histories, Memoirs, etc.

Field-Marshal Earl Alexander of Tunis, *The Alexander Memoirs, 1940-1945*, John North (ed.), Cassell & Company, Ltd., London, 1962.

General Mark W. Clark, *Calculated Risk*, Harper & Brothers, New York, 1950.

W.G.F. Jackson, *The Battle for Italy*, Foreword by Field-Marshal Earl Alexander of Tunis, B.T. Batsford Ltd., London, 1967.

_____, *The Battle for Rome*, B.T. Batsford Ltd., London, 1969.

Roderic Owen, *The Desert Air Force*, Hutchinson & Co., Ltd., London, 1948.

G. A. Sheppard, *The Italian Campaign, 1943-45*, Introduction by Field-Marshal Lord Harding, Frederick A. Praeger, New York, 1968.

Wing Commander J. C. Slessor, *Air Power and Armies*, Oxford University Press, London, 1936.

Marshal of the Royal Air Force Sir John Slessor, *The Central Blue: Recollections and Reflections*, Cassell & Company, Ltd., London, 1956.

Marshal of the Royal Air Force Lord Tedder, *With Prejudice*, Cassell & Company, Ltd., 1966.

_____, *Air Power in War*, The Lees Knowles Lectures, Cambridge 1947, Hodder and Stoughton, London, 1947.

Lt. Gen. Lucien K. Truscott, Jr., *Command Missions*, E. P. Dutton & Company, New York, 1954.

THE GERMAN SIDE

Contemporary Records

War Diary of the Tenth Army (Kriegstagebuch #6, ABTLG. Ia, AOK 10). Daily diary kept by the Operations Branch, Hq., Tenth Army, covering period 1 April-31 May 1944, with many enclosures. Original German classification "Secret" (GEHEIMSACHE). U.S. National Archives, Microfilm #T-312, Roll 91.

War Diary of the XIV Panzer Corps (Kriegstagebuch #6, ABTLG. Ia, XIV Pz. A. Korps). Daily diary kept by the Operations Branch, Hq., XIV Panzer Corps, covering the period 1 January-30 June 1944, with enclosures for period 1 May-16 June. U.S. National Archives, Microfilm #T-314, Roll 1453.

Quartermaster Diaries of the Tenth and Fourteenth Armies, microfilm records in U.S. National Archives.

Postwar Accounts by German Participants Prepared for U.S. Army Historical Division

A series of manuscripts prepared by former high-ranking German officers for the Historical Division, Hq., U.S. Army, Europe. For a complete listing, see Guide to Foreign Military Studies 1945-54, U.S. National Archives. The following manuscripts are pertinent to the study:

Oberst Klaus Stange (Officer in charge of the Italian Transport System), *Railroad Situation from January 1944 Up to the Beginning of the May Offensive (Italy)*, MS D-049.

Oberstleutnant Ernst Eggert (G-4 in the Chief Quartermaster Section of Army Group "C"), *Supply During Allied Offensive May 1944 and Subsequent Fighting to the Apennines*, MS D-128.

Generaloberst Heinrich von Vietinghoff, *The Campaign in Italy: The Operations of 71 German Infantry Divisions During the Month of May 1944*, MS-C-025.

Generalleutnant Wilhelm Schmalz, *Einsatz der Fallschirm-Panzerdivision "Hermann Göring" in Italien vom 26 May-5 Juni 1944 (Deployment of the Hermann Göring Parachute-Panzer Division in Italy from 26 May-5 June 1944)*, MS C-087b.

General der Panzertruppen Frido von Senger und Etterlin, *War Diary of the Italian Campaign: Cassino*, MS C-095b.

_____, *Comments on Chapter "The German Situation" in the Volume "The Drive on Rome" by Dr. Sydney T. Mathew*, MS C-097b.

Generalfeldmarschall Albert Kesselring, Concluding Assessment of the *Campaign in Italy*, Part II in the series on *Mediterranean War*, Part V, MS C-064.

Books and Memoirs

B. H. Liddell Hart, *The German Generals Talk*, William Morrow & Co., New York, 1948.

B. H. Liddell Hart (ed.), *The Rommel Papers*, Harcourt, Brace and Company, New York, 1953.

Generalleutnant a. D. Heinz Greiner (former Commanding General, 362 Infantry Division), *Kampf un Rom -- Inferno am Po*, Kurt Vowinckel Verlag, 1968.

Generalfeldmarschall Albert Kesselring, *Kesselring: A Soldier's Record*, William Morrow & Co., New York, 1954.

General Frido von Senger und Etterlin, *Neither Fear Nor Hope*, E.P. Dutton & Co., New York, 1964.

General Siegfried Westphal, *The German Army in the West*, Cassell & Company, Ltd., London, 1951.