When the Cold War ended in 1989, symbolized by the destruction of the Berlin Wall, the United States entered a markedly changed security environment. In the course of a few years, that environment had changed from a bipolar world in which two superpowers confronted each other around the globe to a world in which the United States is the only global superpower among many regional powers and many regional conflicts. The resulting demand for U.S. presence or intervention has required deployments ranging in size and purpose from Operation Desert Storm and Operation Allied Force, through Northern and Southern Watch and Uphold Democracy,\(^1\) to humanitarian relief and noncombatant evacuation operations.

The Air Force has played a large role in these operations, and the pace of its activity has not abated: Figure 1.1 illustrates the range of deployments the Air Force has faced in the 1990s (before Operation Allied Force in Kosovo). Not only are the operations far-flung, but many were initiated with short lead times in response to potential crises. Many of these operations involved patrol or combat (e.g., Desert Storm, Allied Force, Northern and Southern Watch), whereas many others were and remain deterrent in nature—U.S. forces are

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\(^1\)Operation Desert Storm was the U.S.-led war to evict Iraq from Kuwait. Operations Northern and Southern Watch are allied operations to prevent Iraq from making military flights in U.N.-designated no-fly zones. Operation Uphold Democracy reinstalled Haitian president Aristide by removing a military junta.
stationed in critical regions to ensure a quick response if conflict occurs but are not actively engaged in combat or patrol missions. Note that even in Southwest Asia (SWA) there have been deployments such as Phoenix Scorpion whose primary purpose was to increase force levels in response to sudden Iraqi troop movements.

The number, frequency, and uncertainty of these deployments have created a number of problems for the Air Force. The deployments in the latter half of the 1990s are being carried out by a substantially smaller force than existed in the 1980s or even during Desert Storm. This has resulted in personnel turbulence, as specialists in critical fields are frequently sent on lengthy deployments, and increased workload, both for the deployed personnel and for the people left behind who must cover the home-base workload of those deployed. This turbulence has been blamed for a decrease in retention,² which,

²See, for example, Paul Richter (November 22, 1998). However, other research has shown that some deployment may improve retention. See Hosek and Totten (1998).
coupled with continually declining defense expenditures, has been linked by some to recent troubling decreases in overall readiness. 3

THE EXPEDITIONARY AEROSPACE FORCE

To meet the challenges of the new security environment, the Air Force has formulated the Expeditionary Aerospace Force (EAF) concept. 4 Under this concept, the response to a fast-breaking crisis is to deploy a tailored air power force rapidly to the crisis area from bases primarily in the continental U.S. (CONUS), in contrast to the previous posture where forces were deployed overseas in areas of concern for lengthy periods as deterrents or in anticipation of crisis situations. The ability to respond rapidly to a crisis 5 from CONUS would greatly reduce the need to have forces deployed in critical areas purely for deterrence; such forces should also be more flexible in that they could deploy to any crisis area without first withdrawing from a current deployment, an action that often has political implications and restrictions. 6

The EAF concept addresses many of the problems currently experienced. First, keeping most units in CONUS except when deployed

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3 Again, this has been the subject of many news stories. See Paul Richter (November 17, 1998) or Matthew Williams (September 28, 1998).

4 See Davis (1998) for a description of the origin and early development of the EAF idea. Davis notes that the USAF has had “expeditionary” units before, notably the 19th Air Force, which was a headquarters unit designed to move quickly into theaters of operation and start employing arriving air units. One-third of the members of the 19th were jump-qualified.

5 Rapidly deployable air power could be critical even in larger conflicts such as Major Theater Wars (MTWs): as a result of the Quadrennial Defense Review (QDR), analysts at RAND and the Air Staff pointed out that the effect of air power was being systematically undervalued in some combat assessments of potential MTW force mixes. The rapid deployment of air power, they asserted, could be used to blunt major armored attacks (such as occurred during the seizure of Kuwait by Iraq in 1990) without the necessity of engaging the enemy with major formations of friendly ground forces (Ochmanek, Harshberger, and Thaler, unpublished RAND research). However, to be effective halt phase (or effect-based) operations would require very rapid deployment and immediate employment, as well as a demanding operations tempo for the first few days of the battle.

6 In one instance, Saudi Arabia temporarily blocked U.S. attempts to move U.S. aircraft within the country to other SWA locations in preparation for operations against Iraq. See Washington Post (February 3, 1998).
for a crisis situation should greatly decrease the extended deployments for deterrent purposes that are partially blamed for the retention problem. Second, rotating deployment responsibilities among units (so that each unit is on-call for a specified period of time) would create more predictability in planning unit activities such as training and periodic maintenance. The reduction in uncertainty about sudden deployments would also increase the quality of life for personnel. Finally, using some of the on-call units to staff the rotation requirements would even out these burdens.

These considerations led the Chief of Staff of the Air Force (CSAF) to hold a press conference in August 1998 at which he announced that the Air Force was adopting the EAF concept as its basis for responding to small-scale contingencies and staffing rotations and described the framework for moving the force to an expeditionary posture. Emphasizing that there were many more details to be decided, he outlined the division of the active forces into 10 Air (later "Aerospace") Expeditionary Forces (AEFs), each a mixture of fighters, bombers, and tankers. This organization aligns forces from the current predominantly single-MDS (mission/design/series) wing structure with the 10 AEFs; it is to be operational by January 2000. Two of the AEFs will be on call for a 90-day period, when elements from those AEFs could be deployed for any crisis needing air power. The on-call period will be followed by a 12-month period during

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7 Press conference August 4, 1998, at the Pentagon, held by Acting Secretary of the Air Force F. Whitten Peters and CSAF Gen Ryan. This is the most comprehensive of several talks on the subject by Gen Ryan. See Ryan (1998).

8 There is a terminology problem in discussing the structure and employment of expeditionary forces: although the basic concept has remained the same, the name has gone through several iterations. The original expeditionary force package, tailored to SWA, was a 30- or 36-ship fighter package, which was termed an Air Expeditionary Force (AEF). The concept was broadened to include other types of missions, including humanitarian and space support (hence the replacement of “Air” by “Aerospace”). Finally, as it became clear that this would be a significant shift in Air Force culture, the new organizational concept was named the EAF, which has been implemented by dividing the Air Force into AEFs as noted in the text. The generic term for the force package actually employed is Aerospace Expeditionary Task Force (ASET), which we will use here, although AES (for squadrons), AEW (for wings), and AEG (for “groups”) have been used. We will use EAF and AEF as defined in the CSAF briefing. See Air Force Glossary, AFDD 1-2, July 1999.
which the unit will carry out normal training activities. The deployed forces will be tailored in size and/or capability to match the requirements of the situation. The details of the implementation are expected to evolve.

As the EAF concept has been developed, it has become clear that the move to an Expeditionary Aerospace Force will require extensive rethinking and reengineering of most of the Air Force; some have described it as a “cultural shift.” Whereas the previous focus of the United States was on the European theater against the Warsaw Pact, and, to a lesser extent, on war on the Korean peninsula, now there is uncertainty in location, uncertainty about the enemy, and uncertainty about intensity, duration, and forces. The operational challenges to such a mode of fighting are many: obtaining intelligence information, formulating target lists, and devising operational plans all while deploying in preparation for going into action on arrival. In addition, the USAF had largely planned on going to war by deploying to bases with a large U.S. presence in place. The assumption was that only aircraft and personnel would be deployed, and those units would fall in on well-equipped bases. As a result of this focus on fighting from established bases, existing support equipment is heavy and not easily transportable, so that deploying all the support for almost any sized ASETF to an overseas location would be expensive in both time and airlift. In contrast, expeditionary deployments might be made to areas with little or no U.S. presence (such as was the situation at the beginning of Desert Shield). Indeed, the initial statements of the EAF concept talked about operations and supporting a force from austere bases with little if any infrastructure other than a usable runway.

Adapting Agile Combat Support (ACS) to be Expeditionary Combat Support (ECS) is therefore one of the greatest challenges posed by expeditionary operations. In an expeditionary world, agility requires that support processes be capable of supporting rapidly deployed forces, either by deploying rapidly themselves or by connecting support processes in permanent locations to the deployed forces.

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In the case of an MTW, on-call forces might well be used for a first, fast response, but forces in other parts of the cycle will be called as needed to carry out their various MTW missions.
This reshaping of support in implementing the EAF has been the focus of our research.

**EXpeditionary Combat Support**

The Air Force faces a significant challenge in adapting support to a world of short-notice deployments, expeditionary operations, and fast-breaking theater conflicts. Much of the effort so far has focused on the logistics aspects of execution, i.e., how to compress the time required to deploy a unit’s logistics support, given current processes and equipment. The Air Force has made progress in that area, as can be seen in Figure 1.2.

Figure 1.2 illustrates the current Air Combat Command (ACC) standard for deployment: 72 hours of strategic warning, followed by 24 hours to start the deployment, followed by another 18–24 hours to arrive in the theater, prepare the aircraft for combat, and begin to launch strikes. The ovals list the execution tasks to be accomplished

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**Figure 1.2—Deployment Timelines**

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*a AEF 4 experience.

*b For 24 PAA units (AFI 90–201, ACC SUP 1, 1 Jan 96).
when strategic warning is given. “AEF 4” (the 4th Fighter Wing’s short-notice deployment to Qatar)\textsuperscript{10} made substantial improvement on that timeline, but the goal for the EAF is more stringent still.

Rather than addressing execution, our research concentrates on the strategic decisions that will design the logistics infrastructure to support rapid deployments. Figure 1.3 illustrates the relationship of strategic decisions to the execution decisions listed in Figure 1.2.

The ovals indicate areas outside the deployment/redeployment execution that need to be addressed. Many of these areas are topics of ongoing RAND research: logistics command and control (C2), preparation of deploying units, policies for preparing airlift and

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\textsuperscript{10}Since the advent of the EAF concept, several of the deployments to SWA for rotational duties have been termed “expeditionary” and were numbered in sequence. In AEF 4 the actual start order for the deployment was given on short notice, although the wing knew that it was scheduled to deploy and had undergone preparation. The current usage of AEF is more general.
tankers, and preparation of theater infrastructure. In addition, reconstitution requirements need to be considered in each of the areas. We concentrate on theater infrastructure, but first briefly describe the other strategic decision areas.

Logistics C2 is the planning and coordination of ASETF logistics support, including selecting units and the deployment bases, determining the capabilities of the base, and coordinating the deployment. The urgency of the deployments requires that expeditionary logistics C2 be much faster and much more closely linked to operations than is the current practice.

Deploying-unit preparation is the coordination of unit preparation activities so that an ASETF can deploy quickly and operate with minimal overhead for an initial time if it is called during its on-call period. In aircraft maintenance, for example, preparation for an ASETF may include finishing required periodic inspections and modifications (Time Compliance Technical Orders, or TCTOs), and changeout of engines so that little scheduled maintenance will be needed at the base. Personnel preparation would include field training for austere billeting, small-arms training, and medical preparations. Airlift/tanker preparations might include streamlining the process of developing the deployment schedule (Time-Phased Force Deployment Database, or TPFDD), investing in tanker bases, prepositioning tanker and airlift assets and crews on strategic warning, and collocating airlift assets with first-deploying units such as security police for force protection.

THEATER INFRASTRUCTURE PREPARATION

In the original EAF concept, ASETFs would be able to deploy to any airfield around the world that had a runway capable of landing the operational and airlift aircraft. Some such airfields are fully equipped military bases; others could be "bare bases," with a minimum of infrastructure. To be flexible and truly expeditionary, an ASETF’s reliance on prepositioned equipment and materiel was to be minimized if not eliminated.
However, analysis by RAND (see Chapter Four) and others\(^\text{11}\) shows that prepositioned equipment and supplies cannot be eliminated; current logistics processes and equipment are simply too complex and heavy to deploy rapidly. New technologies and policies can improve this situation in the mid to long term, but implementing the EAF over the next few years will require some judicious prepositioning. Providing Agile Combat Support for the EAF today requires an expeditionary basing structure for support.

To analyze the required basing structure, we first developed the analytical framework described in Chapter Two. This framework uses a series of models that evaluate the major logistics processes in terms of their airlift requirements, time to move and set up, and cost. We address five major categories of resources: munitions, POL support (part of base support), unit maintenance equipment (the bulk of unit support equipment), vehicles, and shelter. These five commodities make up the majority of support materiel for an air operation. Figure 1.4 shows what these proportions were for the 4th Fighter Wing’s deployment to Qatar; other deployments had similar patterns.

This recent deployment did not take place on very short notice nor was there substantial reengineering to tailor support processes and equipment. Our models represent the individual processes in enough detail so they can be used to evaluate such process modifications.

Chapter Three shows that to meet the demanding timelines and operating tempos (optempos) some thought must go into building up infrastructure in all theaters where ASETFs could be deployed. Even though access to much or all of the infrastructure would be under the control of a foreign government, some risks must be taken to meet the deployment and employment goals.

Decisions about what and where to preposition are the basis of infrastructure preparation. Tradeoffs among a number of competing objectives must be analyzed: timeline, cost, footprint, risk, and flexibility. Prepositioning everything at the base from which operations

\(^\text{11}\)“Bare Base Analysis,” briefing presented by AF/ILXX to Lt Gen Handy, AF/IL, on May 10, 1998. The briefing summarizes work done by ILXX and Synergy, Inc.
Figure 1.4—Breakdown of Support for AEF 4

will be flown reduces to a minimum the timeline and required airlift, but it also reduces flexibility, adds political and military risk, and incurs a substantial cost if several such bases are to be prepared. Bringing support from CONUS or a theater support location increases flexibility and reduces risk, but takes longer and requires more airlift.

Before describing in the next three chapters a methodology that allows us to assess how different configurations perform and analyze the tradeoffs in designing a forward infrastructure that meets Air Force needs, we briefly define the four basic components of forward infrastructure. First is the Forward Operating Location (FOL) from which the aircraft fly their missions. Many types of airfields are suitable for air operations; the different types of FOLs will be described more fully in Chapter Three. Each category of FOL requires different amounts of equipment to be brought in to prepare the FOL for operations and therefore has a different timeline and transportation requirement. One key decision about theater infrastructure is how many FOLs of each type the Air Force needs in a critical area and whether the United States will commit to equipping them with
prepositioned equipment if needed to make deploying an ASETF easier.

The second component is the Forward Support Location (FSL), a support facility outside of CONUS but not (necessarily) in a crisis area. FSLs can be depots for U.S. war reserve materiel (WRM) storage, for repair of selected avionics or engines, a transportation hub, or a combination thereof. An FSL could be manned permanently by U.S. military or host-nation nationals, or simply be a warehouse operation until activated. The exact capability of an FSL will be determined by the forces it will potentially support and by the risks and costs of positioning specific capabilities at its location.

The third and fourth components are assured transportation/resupply and logistics C2. If ASETFs must deploy with minimum support and depend on resupply from either CONUS or a set of FSLs, they will need to have an assured resupply link whose responsiveness aligns with the support that is available at the FOL. If they deploy to a truly bare base, resupply will be required to keep vital supplies such as munitions flowing. Without the needed assured resupply, ASETFs will not be able to carry out their missions. The strategic infrastructure envisioned here will require a more sophisticated support C2 structure to coordinate support activities across FOLs and FSLs connected by a rapid transportation system. These last two components are the subject of current RAND research.

The theater infrastructure is a combination of FOLs, FSLs, and assured resupply. Our contribution here is to provide tools and a pro-

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12 Assured transportation or resupply has been a contentious issue between deploying forces and theater Commanders-in-Chief (CINCs). If ASETFs increase their deployment speed by relying on support functions at FSLs or in CONUS, they will require frequent resupply to remain effective. As we will show below, prepositioning complete sets of supplies at numerous FOLs is probably not economically feasible and may be politically risky. However, when a crisis requires the rapid deployment of ground troops, the airlift requirement of the latter far exceeds the amount required even by large air units. Further, by doctrine the CINC has complete control of transportation into the theater, and partially deployed fighter wings did have resupply cut off for a time in Desert Shield. Although it would be prudent to have redundant transportation links from FSLs to FOLs, theater transportation infrastructure may limit their availability. Ultimately, the EAF concept requires a thorough understanding of what the transportation needs are for ASETFs and what would be the impact of interrupting that resupply flow.
totype of the analysis and planning that we believe the Air Force must do to prepare to deploy quickly to crisis spots around the world. The results are not definitive but should provide a starting point for evaluating alternative forward infrastructures for any theater and a wide range of ASETF deployments.