

## The Navy's Tactical Aircraft Strike Planning Process

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**P**lanning tactical aircraft strikes aboard the Navy's aircraft carriers is a complex process involving many different organizations, people, data, and computer systems. The process occurs within a series of events called the strike planning cycle. This repetitive cycle begins with the reception of a task and ends with the collection of strike assessment data. Within the cycle lie steps for strike planning that are divided into functional areas such as weaponeering and asset coordination. Planners are assisted by organizations that perform functions such as intelligence analysis and weather forecasting. Automated systems are used in the aircraft carrier's intelligence center to process the high volume of data that influence planning decisions. This article describes the Navy's tactical aircraft strike planning process and provides insights into the challenges facing future strike planning efforts. (Keywords: Aircraft Carrier Intelligence Center, Strike planning, Tactical aircraft.)

### INTRODUCTION

"Basher 52, this is Basher 11."

"Basher 52, this is Basher 11. Are you up on this frequency?"

"This is Basher 52."

"Say again. Understand this is Basher 52."

"This is Basher 52. I'm alive."

"Say again, Basher 52. You are weak and unreadable. This is Basher 11."

"This is Basher 52!" [Pause]

"Basher 52, what squadron were you in at Kunsan?"

"Juvats! Juvats! I'm alive!"

"Copy that. You're alive! Basher 52, sit tight and come back up at 15 past the hour."

At 0200 on 8 June 1995, this radio conversation occurred between Air Force Captains Scott O'Grady (Basher 52) and T. O. Hanford (Basher 11).<sup>1</sup> It was the first contact with O'Grady since a Bosnian Serb SA-6 surface-to-air missile (SAM) slammed into his single-seat F-16 fighter aircraft, forcing him to eject into hostile territory on 2 June 1995. The contact occurred during Hanford's reconnaissance flight, and it touched off a furious round of final preparations for a rescue mission.<sup>2</sup>

During the 6 days before the rescue, the Navy and Marines convened a crisis action team onboard the USS *Kearsarge* (LHD-3) in the Adriatic Sea to plan a combat search and rescue (CSAR) mission. Many decisions had to be made in these planning sessions.

## GLOSSARY

AIC	Atlantic Intelligence Command	MIIDS/IDB	Military Intelligence Integrated Data System/Integrated Data Base
AIM	Air intercept missile	MISREP	Mission report
APS	Afloat Planning System	MSI	Multisource interpretation
ATO	Air tasking order	NIPS	Naval Intelligence Processing System
ATP	Advanced tactical processor	NIS	National input segment
AWACS	Airborne Warning and Control System	NSA	National Security Agency
BDA	Battle damage assessment	OOB	Order of battle
CAG	Carrier Air Wing Commander	PC	Personal computer
CCDB	Common cryptologic database	PPDB	Point-positioning database
CCTV	Closed-circuit television	PTW	Precision Targeting Workstation
CIA	Central Intelligence Agency	RECCEXREP	Reconnaissance exploitation report
CMSA	Cruise Missile Support Activity	SAM	Surface-to-air missile
COMINT	Communications intelligence	SAO	Special Activities Office
CSAR	Combat search and rescue	SAR	Synthetic aperture radar
CTAPS	Contingency TACS (Theater Air Control System) Automated Planning System	SEAD	Suppression of enemy air defenses
CV/CVN	Aircraft carrier	SIAC	Strike intelligence analysis cell
CVIC	Carrier Intelligence Center	SIGINT	Signal intelligence
CVW	Carrier air wing	SPA	Strike Planning Archive
C <sup>4</sup> I	Command, control, communications, computers, and intelligence	SPINS	Special instructions
DIA	Defense Intelligence Agency	SPRAC	Special Processing and Reporting Activity Network
DIWS-A	Digital Imagery Workstation Suite-Afloat	SSC	Surface surveillance coordination
DMA	Defense Mapping Agency	SSES	Ship's signal exploitation space
DoDIIS	DoD Intelligence Information System	STRED	Standard tactical receive equipment display
ELINT	Electronic intelligence	SUPPLOT	Supplemental plot
EO	Electro-optical	TAMPS	Tactical Automated Mission Planning System
EOTDA	Electro-optical tactical decision aids	TARPS	Tactical Airborne Reconnaissance Pod System
FLIR	Forward-looking IR receiver	TDP	Tactical data processor
FOSIF	Fleet Ocean Surveillance Intelligence Facility	TEAMS	Tactical EA-6B Missile Support System
HARM	High-speed Anti-Radiation Missile	TESS	Tactical Environmental Support System
IR	Infrared	TIS	Tactical input segment
IREPS	Integrated Radar Effects Prediction System	TOPScene	Tactical Operation Preview Scene
ISAR	Inverse synthetic aperture radar	TRAP	Tactical recovery of aircraft and personnel
JAC	Joint Analysis Center	TRE	Tactical receive equipment
JDISS	Joint Deployable Intelligence Support System	TSA	Target Selection Analysis (publication)
JIC	Joint Intelligence Center	TSCM	Tactical Strike Coordination Module
JICPAC	JIC Pacific	TTPs	Tactics, techniques, and procedures
JMCIS	Joint Maritime Command Information System	TUT	Technology upgrade to TEAMS
JMEM	Joint Munitions Effectiveness Manual	UAV	Unmanned air vehicle
JSIPS-N	Joint Services Imagery Processing System-Navy	USACOM	U.S. Atlantic Command
LSP	Launch sequence plan	USCINCPAC	U.S. Commander-in-Chief Pacific
METOC	Meteorological and Oceanographic Center	VTC	Video teleconferencing
MEU	Marine expeditionary unit	5D	Demand-driven direct digital dissemination

How large a force and precisely which aircraft with what weapons were needed? What threats were present in the rescue zone, and how were those threats best countered? Which routes would optimize use of terrain masking? What time was best for the rescue? What rules of engagement were needed? What were the “no-go”

criteria for calling off or delaying the rescue? These were just some of the critical issues that had to be addressed.

This article describes the Navy's process for answering these (and other) mission planning questions. Specifically, the planning process for tactical aircraft

strikes is presented as it occurs onboard the Navy's aircraft carriers (CVs). For our purposes here, "mission planning" means preparation to provide a crew with all necessary information and material to successfully deliver a weapon against an assigned target or complete a non-weapon-related objective (such as CSAR); "strike planning" means the coordination and collection of missions into packages that allow the successful delivery of multiple weapons and the completion of multiple objectives.

The information in this article was gathered by the author during interviews with Fleet experts and via observations at training centers and exercise sites, the highlight of which was a cruise aboard the USS *Enterprise* (CVN 65). Numerous interviews and observations were necessary because the entire strike planning process draws upon many different organizations, people, and data. Whereas most related literature describes only a narrow part of the process, this article shows the interrelationship of these seemingly disjointed elements of strike planning, which is essential for systems-level evaluations of the overall strike planning process. To this end, the final sections of the article focus on improvement initiatives for ensuring continued strike planning success. As a prelude to these initiatives, the following sections describe the four primary components of the strike planning process:

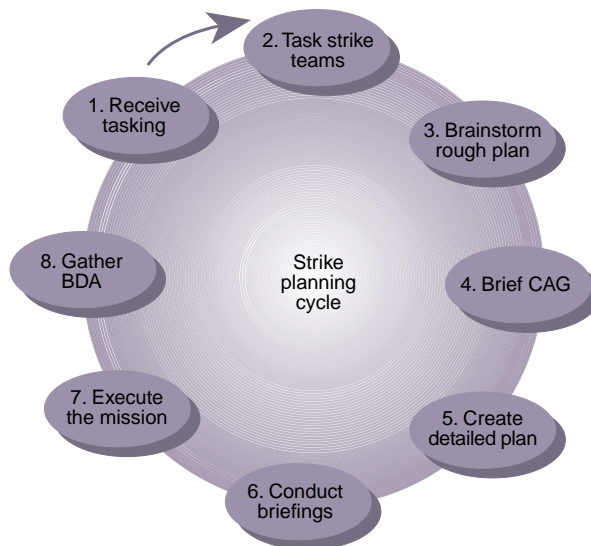
1. The strike planning cycle
2. Strike planning functions
3. The CV Intelligence Center (CVIC), intelligence gathering, and support functions
4. Automated support systems

## THE STRIKE PLANNING CYCLE

The strike planning process occurs within the context of a sequence of events called the strike planning cycle. This repetitive cycle begins with receipt of a task and ends with the collection of strike assessment data as shown in Fig. 1. This figure will be expanded throughout the article to graphically depict the relationships among various strike planning activities, spaces, and systems. In this section, we place the strike planning cycle into perspective with the command decision process and describe the cycle's individual components.

### Air Tasking Order

Before strike leaders of tactical aircraft ever assemble to plan the details of a strike, many decisions have already been made at a national level by the National Command Authority, Joint Chiefs of Staff, and Commanders in Chief. These decisions, which approve targets, weapons, strategic objectives, etc., are passed to the military services and are progressively refined by the



**Figure 1.** The strike planning cycle (consult glossary for the definition of acronyms in this and subsequent figures).

Joint Forces Commander, the Joint Forces Air Component Commander, Strike Warfare Commanders, and Battlegroup Commanders. For tactical aircraft, this progressive refinement leads to an Air Tasking Order (ATO), which, along with special instructions (SPINS), serves as the foundation upon which CV-based strike teams begin their planning.

Depending on the nature of the conflict being addressed, the ATO and SPINS can provide very specific information, down to the desired mean point of impact and basic encyclopedia (a compilation of identified installations and physical areas of potential significance as objectives of attack) designation. In other situations, tasking may only state objectives from which specific target data must be determined onboard the carrier.

Generation of an ATO is cyclical, and at any particular time, several ATOs may be developing.<sup>3</sup> It typically takes 72 hours to complete a single ATO. Contingency strikes are developed throughout deployments, however, and in emergency situations the time line can be compressed to 4 to 8 hours.

### Strike Teams

Once the ATO and SPINS are complete, they are provided to CV-based strike teams via the Contingency Theater Air Control System Automated Planning System (CTAPS), usually about 12 to 18 hours before launch. A strike team generally includes one representative from each air wing squadron. Each squadron is responsible for the role of a particular aircraft (e.g., EA-6B, ES-3A, E-2C, F-14, and F/A-18), a role commonly referred to as an *element* of the strike. Strike

teams—as many as eight or nine—are designated before deployment to facilitate training and to ultimately provide rapid response when an ATO is received and the Carrier Air Wing Commander (CAG) assigns a particular team to plan a real strike. Each strike team has a designated leader, who, with help from squadron representatives, is responsible for generating a strike plan to satisfy the ATO.

### Planning Overview

Initial strike planning is dynamic and interactive. Each squadron representative provides a particular expertise that allows the strike team to quickly brainstorm a reasonably complete, but rough, high-level plan. This brainstorming process involves such activities as selecting appropriate ordnance, determining threat avoidance and suppression techniques, exploiting terrain, and determining the best approach and timing for the strike. Brainstorming fosters consideration of multiple alternatives to determine the best overall approach for achieving strike objectives.

Once developed, the rough plan is briefed to the CAG by the strike team leader. This briefing, commonly called the laptop brief, is essentially an informal progress report. The CAG's questions and suggestions present alternatives and contingencies.

Having incorporated feedback from the CAG, the strike team leader tasks all members of the team to plan the details in their areas of expertise. This process involves a wide range of activities including weapon selection, determination of waypoint (point or series of points in space to which an aircraft may be vectored), fuel usage calculation, time line development, and communications planning. Throughout the planning process, it is also important to assess the likelihood of various risks, to carefully consider go/no-go criteria, and to plan alternative courses of action. The strike team leader ensures that each part of the plan is integrated into a cohesive and comprehensive whole.

Several computer systems aid the planning process, most notably the Tactical Automated Mission Planning System (TAMPS). This interactive, graphical system gives aircrew planning tools for integrating aircraft and weapon system mission roles. Connected to TAMPS are databases that supply information on mapping, charting, geodesy, imagery, intelligence, the environment, and aircraft and weapon performance. (Computer support for the strike planning process is discussed further in this article under Automated Support Systems.)

### Briefings

About 3 hours before the strike is executed, a series of briefings is initiated. The overall briefing is given by the strike team leader to all strike participants. The strike is placed into perspective within the ongoing

conflict, and the strike plan, along with its associated materials (e.g., aviator kneeboard cards; see section on Products of the Seven Functional Steps), is explained. During the briefing, a representative from the Meteorological and Oceanographic Center (METOC) will provide weather-related flight data. An intelligence officer will also brief strike participants regarding the order of battle (OOB) and threats. The overall briefing is typically conducted in the CVIC and viewed in ready rooms and command centers throughout the CV via closed-circuit television (CCTV).

Element briefings, which commonly occur in ready rooms immediately after the overall briefing, allow strike participants with a particular responsibility to discuss details specific to an individual element. The final portion of this cascade of briefings occurs as the flight crew for each aircraft meet to discuss personal responsibilities within the cockpit.

### Mission Execution

With details firmly in mind, flight crews and aircraft launch off the deck of the CV to execute the strike. Before launch, the aircraft's weight and weapon loadout (the particular set of weapons attached to the aircraft) are factored into fuel usage calculations. The amount of fuel at launch is often based on weight and route parameters, and airborne refueling with tankers (e.g., KA-6 and S-3B aircraft) is carefully planned. Despite exceptional attention to detail, however, the plan must be robust enough to accommodate unexpected events ranging from undetected SAM sites to weather changes. Replanning may also occur during mission execution, for example, in response to target or threat movements.

### Battle Damage Assessment

In campaign operations, multiple strike planning cycles may overlap. Thus, the quick acquisition of battle damage assessment (BDA) data is a critical part of target prioritization efforts for subsequent strikes. Without proof of success, targets often must be restruck before the campaign can proceed. Because a conflict can frequently cease as soon as a strategic advantage is achieved, rapid feedback is also necessary for political reasons. Returning strikers provide BDA data in two primary forms: verbal debriefings and data from flight imagery recording systems. Both forms are processed in the CVIC. The BDA data can also be obtained from national and theater sensors.

## STRIKE PLANNING FUNCTIONS

Creation of a single-strike plan typically begins with targetteering (see below). Once targets and target characteristics are determined, weapons are assigned to achieve an objective level of damage, and threats are

assessed for suppression to ensure sanctuaries for weapon delivery. This analysis also helps determine which strike assets are needed at what times to ensure a successful strike. Then it remains to determine the specific ingress and target area as well as egress tactics, techniques, and procedures (TTPs) to minimize risks. When all aspects of the strike have been planned, it is then rehearsed to increase familiarity and to make refinements.

These single-strike planning functions are performed by the strike team in the “brainstorm rough plan” and “create detailed plan” steps of the strike planning cycle (Fig. 2). In addition, the strike leader integrates the single strike with other strikes and operations to achieve maximum military effectiveness.

### Targeteering

Targeteering involves evaluating the vulnerabilities of an adversary’s military, political, and economic systems and determining the effects of loss or impairment to those systems.<sup>4</sup> Data from many intelligence sources support targeteering and enable the most effective use of resources in defeating an adversary. Intelligence personnel gather target data continually and activate intelligence collection assets to fill in data shortfalls. Quick input from BDA assessments is also critical to the efficient use of resources and risk minimization.

### Weaponneering

Weaponneering involves determining the best weapon to employ in the most efficient quantity to achieve an objective damage level on a target. Weaponneering considers target construction and materials as well as weapon capability, reliability, accuracy, and delivery parameters. Often, weaponneering plans are severely restricted by collateral damage concerns. The CV engineering support to reconfigure the aircraft with the desired weapons loadout must also be scheduled.

### Suppression of Enemy Air Defenses

This function (SEAD) involves defeating an adversary’s air defense system to create sanctuaries for strike operations. Air defense systems vary in complexity and organization and may consist of ground- and air-based elements. Ground-based air defense systems range from isolated SAM sites to antiair artillery and SAM sites under radar guidance and C<sup>4</sup>I (command, control, communications, computers, and intelligence) control. (This C<sup>4</sup>I system type is referred to as an integrated air defense system.)

Suppression can occur prior to or concurrent with the strike. The objective of SEAD before a strike is to make available permanent sanctuary via threat hard-kill. Concurrent SEAD maintains an element of

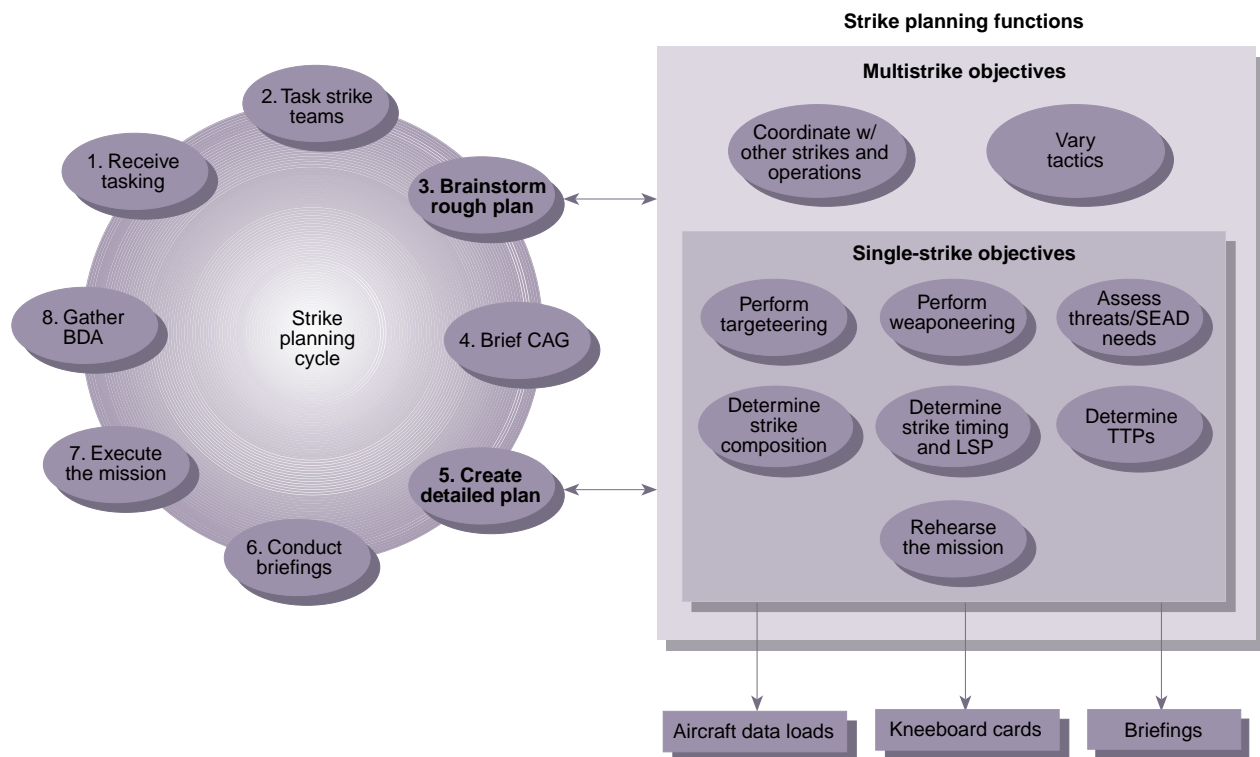


Figure 2. Strike planning functions.

surprise but must be deconflicted with the other strike elements; it may also only require softkill of the air defense system. Electronic warfare aircraft (e.g., EA-6B) are used for jamming and to target enemy air defenses with antiradiation missiles. The Tomahawk Land Attack Missile is another prime weapon of choice for hardkill SEAD.

Enemy air-based defense systems include fighter aircraft, often with radar and C<sup>4</sup>I connectivity. Such defenses are neutralized with the fighter element of the strike package. This element is typically composed of F-14D Tomcats loaded with a variety of air intercept missiles (e.g., AIM 7s, 9s, and 54s).

### Strike Composition

The strike planning team must also assign aircraft to strike roles and weapons (i.e., determine strike composition) sufficiently to meet an objective probability of damage. Asset availability, ordnance loads, range to target, and timing are all considered. The strike team must decide upon the right mix of attack, electronic warfare, fighter escort, SEAD, and command, control, and communications assets while also planning for BDA, CSAR, and tanking. They may also integrate cruise missiles, special forces, and unmanned aerial vehicles into their plan. The availability of assets directly affects the go/no-go criteria and may influence tactics. Spares must also be assigned to cover aircraft fallouts and aborts.

### Strike Timing and Launch Sequence Plan

Timing is critical to the success of each strike. Deconfliction timing is important for avoiding friendly-on-friendly conflicts. Time-on-target timing is essential for effective SEAD (softkill), for maintaining the element of surprise, and for avoiding blast fragments. Timing between missions is also critical and must account for adversary reaction time. To complicate matters further, environmental components (e.g., wind velocity, cloud cover, precipitation) must also be factored into timing calculations. Each strike is a tightly choreographed event that demands tremendous flight discipline from every aviator.

Once the target-related timing has been calculated, the practical matter of launching aircraft off the deck of the CV must also be scheduled. This schedule is contained in a launch sequence plan (LSP) and is based on factors such as aircraft fuel efficiencies, tanking time, time on targets, and transit time.

### Tactics, Techniques, and Procedures

Tactics, techniques, and procedures are needed for the ingress, target area, and egress phases of the strike. During ingress, planning focuses on avoiding or

suppressing threats and finding the target. A compromise must be struck among the capability to generate the required number of heavily loaded sorties, the safety of the carrier, and the desire to achieve tactical surprise.

In the target area, terrain masking and high speed are used to minimize threat exposure. Deconfliction is coordinated by altitude, geographic location, time, or weapon selection. Variance in time on target and delivery maneuvers is important to avoid blast fragment patterns. BDA collection also begins at this time.

During egress, aircraft regain mutual support quickly and use established procedures for identifying returning aircraft (e.g., identification friend or foe modes, return to force procedures, and no radio procedures), especially in the event of equipment failures. When necessary, jettison areas and pick-up points are used in conjunction with CSAR efforts.

### Mission Rehearsal

Mission rehearsal is a key to building situational awareness and strike familiarity. It can also be used as a strike plan refinement mechanism (somewhat like simulation) to discover and correct problems that might threaten the safety of strike participants.

### Products of the Seven Functional Steps

In executing the seven functional steps comprising single-strike objectives (Fig. 2), strike participants produce three main products: briefings (described previously), aviator kneeboard cards, and aircraft data loads. Kneeboard cards are 5 × 8 in. photocopies of the briefing materials that are affixed to a special board, which is strapped to each aviator's leg just above the knee. Aircraft data loads are physical pieces of equipment about the size of a loaf of bread that store data specific to a given strike. This piece of removable hardware receives a download from mission planning computers in the CVIC. It is then carried to the aircraft where it is connected to avionics systems.

### The Big Picture

In addition to integrating the seven functional steps, the strike leader must place the strike into perspective with prior and anticipated strikes (the planning for which often overlaps with planning for the current strike). The leader must provide strike participants with the "big picture" and must ensure that the strike is well coordinated and deconflicted with other operations, which may include joint services activity. In this higher-level process, the importance of BDA feedback and tactical variation is amplified.

As an element of variation, perhaps the greatest weapon—besides overwhelming superiority—is surprise. Deception is a fundamental element of surprise, intended



to delay hostile responses, dissipate enemy forces, or create enough enemy confusion to gain a controlling advantage in an engagement. It can involve concealment, counterfeiting, decoys, diversion, or evasion and typically exploits the threat decision maker's existing preconceptions. Thus, the strike leader is responsible for much more than the simple execution of the single-strike planning functions.

### THE CVIC, INTELLIGENCE GATHERING, AND SUPPORT FUNCTIONS

Executing the seven strike planning functions is a very complex task, but it is made easier by an extensive network of support.<sup>5</sup> Strike planners and support personnel form a type of "client"–"server" relationship. Spaces and systems must be available for server personnel to acquire, analyze, and integrate data into usable intelligence products. Similar spaces and systems must

be available for the client community to mold those products into a comprehensive and coherent strike plan. Most of these spaces and systems reside in the CVIC, although other forms of support come from spaces such as the METOC, the ship's signal exploitation space (SSES), and the supplemental plot (SUPPLOT). The support functions performed in these spaces and their relationship to the strike planning cycle and strike planning functions are shown in Fig. 3.

Although each air wing squadron has its own ready room aboard the CV for planning its unique activities, the CVIC holds most of the strike planning data and support systems. Thus, the CVIC is the natural meeting place of the multisquadron strike planning team. Activities within the CVIC are led and coordinated by the Carrier Air Wing Intelligence Commander. The commander oversees the activities of about 30 ship's company intelligence specialists and 15 carrier air wing officers, who most often support two 12-hour work shifts. This intelligence group continuously gathers

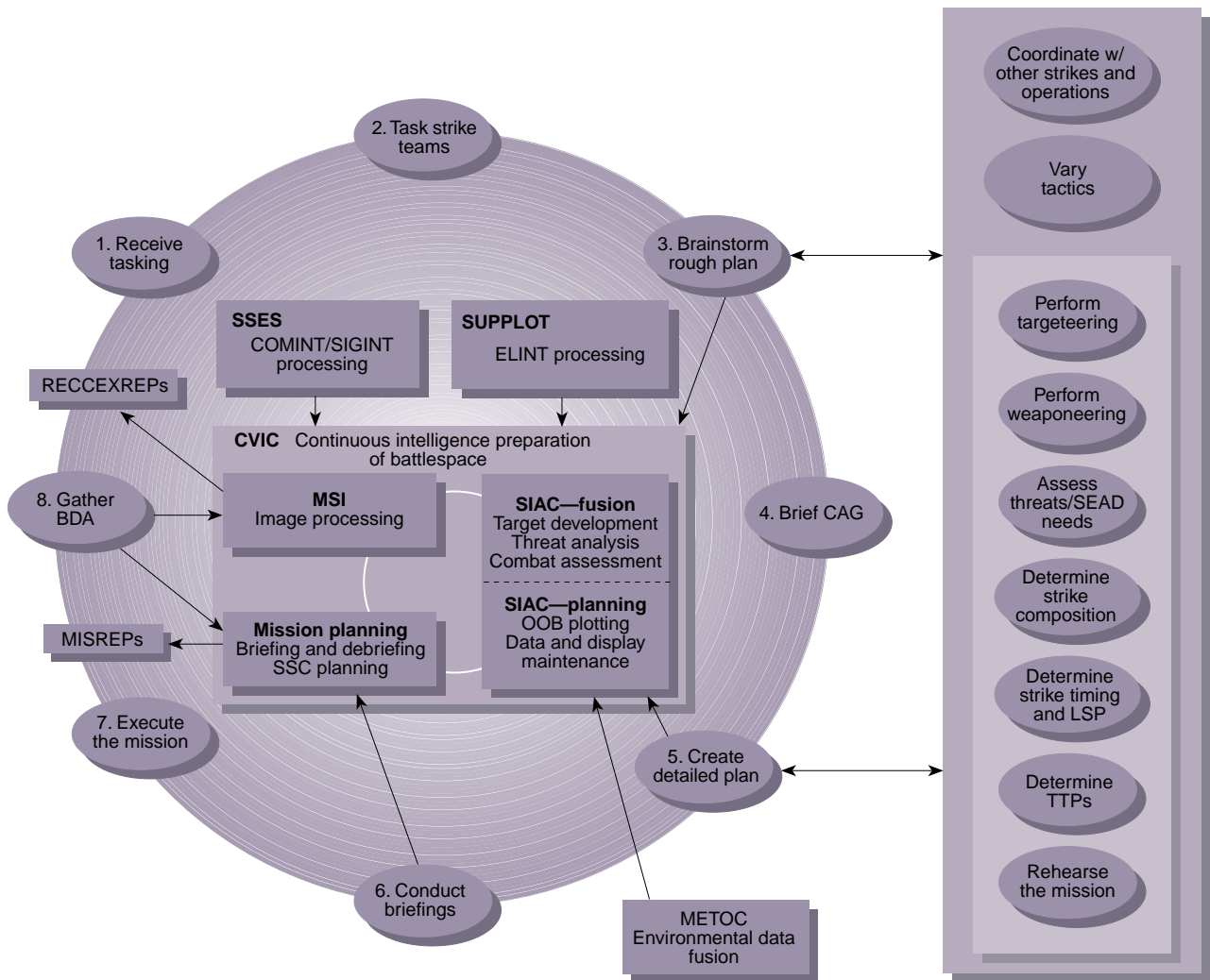


Figure 3. The CVIC and support functions.

information regarding the interests and activities of foreign countries. Much of the data gathering focuses on battlespace environment, target analysis, threat analysis, and strike effectiveness determination. The analysis and integration of these data with a thorough understanding of strike objectives create usable intelligence for strike planners.

Fundamental to CVIC effectiveness is the ability to quickly gather up-to-the-minute strike-related data from appropriate sources. Many organizations provide these data, including the following national and theater intelligence sources: the Central Intelligence Agency (CIA), the Defense Intelligence Agency (DIA), the National Security Agency (NSA), Cruise Missile Support Activities (CMSAs, e.g., USACOM, USCINCPAC), Fleet Ocean Surveillance Intelligence Facilities (FOSIFs), Joint Intelligence Centers (JICs, e.g., AIC, JICPAC, JAC), and national imaging systems (e.g., EO, SAR, IR).

At the attack carrier air wing (CVW) and battle group levels, additional data such as communications, electronic, and signal intelligence (COMINT, ELINT, and SIGINT, respectively) are gathered by resources such as the E-2C, EP-3, and ES-3 aircraft. Imagery is

also obtained by organic assets such as forward-looking infrared receivers (FLIRs), the Tactical Airborne Reconnaissance Pod System (TARPS), and unmanned air vehicles (UAVs). There are also many onboard system-related databases that support the strike planning process (e.g., Military Intelligence Integrated Data System/Integrated Data Base [MIIDS/IDB]). Table 1 summarizes many of the data sources available to strike planners.

Evaluating information from all of these data sources is a daunting task performed by CVW and ship's company intelligence personnel, with help from the METOC, SSES, and SUPPLOT. Together, these groups analyze and integrate huge amounts of data into usable intelligence, which is coherently organized and displayed in the CVIC. This intelligence is provided as a service to clients to create strike plans.

Even though each CVIC has a different layout, they all have three primary support areas: (1) the strike intelligence analysis cell (SIAC), which supports both data fusion and planning, (2) multisource interpretation (MSI), and (3) mission planning. The following subsections provide brief summaries of the functions performed in these areas as well as the sources of data that are used in the process. A summary is provided in Table 2.

**Table 1. Data organization in the strike planning process.**

	Data sources	Data analyzers and integrators		Data users
		CV-based	CVIC-based	
People and organizations	CIA, CMSAs, DIA, FOSIFs, JICs, NSA	METOC SSES SUPPLOT	CV and CVW intelligence	Strike planners
Data and systems	AWACS COMINT ELINT Mission data SIGNT UAV CCDB CVW debriefs DMA charts DoDIIS Intelink JMEMs MIIDS/IDB NIS NIPS PPDB SAO packages Target folders TIS TSAs Weather	EOTDA IREPS TESS ISAR SPRAC ATP STRED TDP TRAP/TRE	APS DIWS-A JDISS JMCIS JSIPS-N Matrix PTW SPA TAMPS TEAMS TOPScene TSCM	TAMPS TEAMS TOPScene TSCM
Sites	Various	CV	CVIC	CVIC and ready rooms

Note: See glossary for acronym definitions.

### The Strike Intelligence Analysis Cell

The SIAC concept evolved from lessons learned in the Persian Gulf War, when a strong need was recognized for a “one-stop intelligence shop.” The SIAC is the focal point for intelligence support to battle group strike operations, specifically strike aircraft, aircrew, and the CAG. The cell also provides support to all warfare commanders as an integral part of the Afloat Joint Intelligence Center (JIC). It addresses the need for each strike team to have common data and analysis regarding targets and threats. Its primary activities involve threat analysis, target development and nomination, combat assessment, OOB maintenance, tactical reconnaissance, and CSAR mission support.

These activities are typically performed by the intelligence community in the data fusion area of the SIAC. Products of this effort (e.g., OOB charts and target folders) are maintained in the planning area of the SIAC for use by strike planners.



**Table 2. Functions performed by intelligence and support staff in CVIC's three primary support areas.**

SIAC	MSI	Mission planning
Threat analysis	Processing of EO,	Briefing
Target development and nomination	IR, SAR, FLIR, and TARPS	Debriefing
Combat assessment	images	Surface surveillance
OOB maintenance		
Tactical reconnaissance		
CSAR mission support		
Tactical display maintenance		

Note: See glossary for acronym definitions.

### Multisource Interpretation

Multisource interpretation is the CVIC's image processing area. Imagery is playing an increasingly important role in target identification and BDA. A battle group will deploy with target folder and Special Activities Office (SAO) imagery for anticipated areas of interest. Additional imagery is obtained via organic assets such as TARPS and FLIR and is processed onboard the carrier. Imagery from national sensors is also obtained via database pulls.

The primary forms of imagery are electro-optical (EO), infrared (IR), and synthetic aperture radar (SAR). EO imagery is excellent for daylight target identification. For night strikes, IR imagery is particularly useful. SAR imagery allows better utilization of aircraft radar displays by flight crews and can also penetrate weather systems, enabling collection of data when EO and IR systems cannot. The timing of a strike—particularly day versus night decisions—often depends on the availability and type of imagery. Imagery of all forms is gathered, processed, and maintained in the MSI area.

### Mission Planning

The CVIC's mission planning area is most often used for briefing and debriefing, as well as routine surface surveillance coordination planning. It is also used by strike planners when multiple strike teams must use the CVIC simultaneously (and, as a result, the SIAC is unavailable). The overall briefing is usually conducted in the mission planning space with CCTV links to the ready rooms. The two primary debriefing products are mission reports (MISREPs), which contain mission history in a textual format, and reconnaissance exploitation reports (RECCEXREPs), which contain imagery products recorded during the mission.

## AUTOMATED SUPPORT SYSTEMS

Automated systems are needed to process the huge amount of data that affect strike planning decisions. Most of these systems reside in the CVIC and are intended for use by both intelligence and strike personnel.

The distribution of automated support systems across the CVIC and support spaces is shown in Fig. 4. Because these systems are the fourth and final component of the strike planning process, Fig. 4 also represents a summary of the process. The three primary functions of the CVIC are shown at the figure's center. Outside support from other onboard organizations and systems is also shown.

Brief descriptions of the automated systems used to fuse strike operations with intelligence and support data to produce a strike plan are provided in the following sections. They are described under the heading of the particular strike planning function that they support.

### Targeteering Systems

When the ATO does not contain specific targets or aim points, these objectives must be determined onboard the carrier. During 1995 Fleet training observations, this process involved the use of many manual calculations along with Target Selection Analysis (TSA) publications and the hard copy of the Joint Munitions Effectiveness Manuals (JMEMs; a 29-volume set of manuals from which strike planners determine appropriate weapon types, quantities, and fuse time settings for specific targets).

Imagery of selected targets and aim points is downloaded from the demand-driven direct digital dissemination (5D) server using the Joint Deployable Intelligence Support System (JDISS). This system connects the carrier with national intelligence databases and allows real-time "chatter" (an e-mail-like capability) with intelligence analysts around the world. It also provides direct access to theater and national imagery resources. This imagery, as well as textual target descriptions and specifications, is collected by CVIC personnel in physical target folders for use by strike planners.

Systems are under development that will streamline targeteering and other strike planning functions. For instance, automated versions of TSA publications and JMEMs are being incorporated directly into other strike planning systems. (Since the 1995 observations, a PC-based version of JMEMs has been made available.) Systems such as Constant Web allow the quick evaluation of the critical links and nodes of a country's integrated air defense system. Other systems such as the Joint Services Imagery Processing System-Navy (JSIPS-N), which includes the Digital Imagery Workstation Suite-Afloat (DIWS-A), along with JDISS/5D, will provide high-quality imagery for coordinate

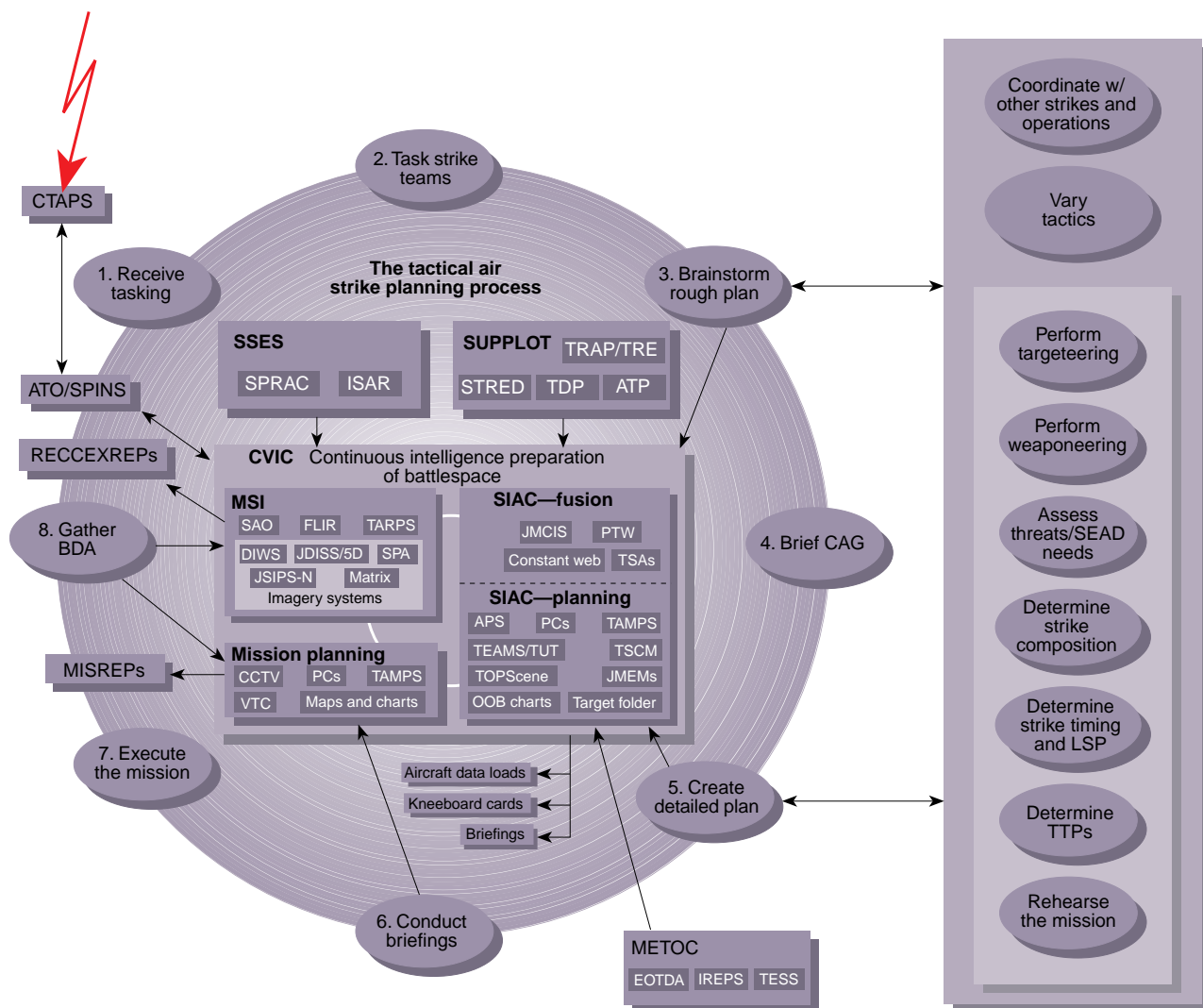


Figure 4. Automated support systems.

mentation and target/aim point identification. The Precision Targeting Workstation (PTW) is another new system that embodies an electronic target folder concept for better handling and storage of target materials, with an emphasis on imagery.

### Weaponeering Systems

Strike planners must assess threats, collateral damage restrictions, and weather conditions in making final decisions regarding weapon selection and delivery parameters. This process relies heavily on JMEMs.

Other systems assisting the weaponeering process include the Tactical Environmental Support System (TESS) and the Integrated Radar Effects Prediction System (IREPS), which provide weather data, radar propagation effects information, and contrail (streaks of condensed water vapor created by an aircraft at high

altitudes) forecasts. TAMPS provides an electronic means for assigning aircraft loadouts. Both PTW and TAMPS will eventually have electronic JMEM databases. These systems will quicken the weaponeering process.

### SEAD Systems

The Tactical EA-6B Mission Support (TEAMS) System/Technology Upgrade to TEAMS (TEAMS/TUT) is the primary SEAD planning tool. It gives EA-6B squadrons intelligence data (e.g., OOB information), worldwide terrain mapping, HARM (High-speed Anti-Radiation Missile) jammer/receiver targeting data, decision aids, aircraft data loads, and postflight analysis.

SEAD efforts are also supported by the Joint Maritime Command Information System (JMCIS), which is designed to provide the overall tactical picture. The

system can be directly connected to many communication sources and equipment such as tactical receive equipment (TRE), the Officer in Tactical Command Information Exchange System, the Tactical Data Information Exchange Subsystem, and the Aegis Combat Detection System. Electronic intelligence collection, correlation, display, and annotation are performed by the JMCIS. It also yields detailed information describing every emitter (e.g., active radar) and can plot emitter histories.

### Strike Composition Systems

The determination of strike composition is a manual process. The strike leader requests asset availability data from each squadron and must compose the strike on the basis of additional inputs such as strike range, timing, threats, weaponeering requirements, and delivery parameters. The JMEmS provide answers to weaponeering concerns, and OOB charts developed using JMCIS provide input on threats.

The Tactical Strike Coordination Module (TSCM) may help run this activity once it is fielded. Its purpose is to manage all of the strike planning functions and provide answers to "what if" strike alternative questions. The TSCM is also being developed to work interactively with systems such as TAMPS, TEAMS, and the Afloat Planning System (APS). It will operate with real-time inputs from JMCIS and the central database server. Thus, detailed missions planned on these systems will be integrated and deconflicted by the TSCM. In addition, this module supports briefing requirements by providing graphics, Gantt charts, annotated maps, and tabular data.

### Strike Timing Systems

Time line analysis is critical for strike integration and deconfliction and must also consider adversary reaction time to minimize the risk from threats. TAMPS and TSCM are developing preview modes that can help uncover time line problems. In this mode, a strike plan is animated on a display screen, making timing problems visually obvious. Eventually, these systems will incorporate smart algorithms to optimize time lines, thereby minimizing risks from threats and allowing strikes to achieve greater success.

The strike leader must also develop an LSP, which dictates the timing associated with launching aircraft from the carrier. This is another manual process that will be automated eventually.

### TTP Systems

TAMPS and TEAMS/TUT are the two primary systems used to plan TTPs. The former is used to develop, analyze, store, and download mission data to aircraft

and standoff or precision-guided munitions. It also provides routes, terrain data, target locations, threat envelopes, and weather conditions using Defense Mapping Agency (DMA) and other imagery products. In addition, TAMPS provides a preview capability for mission rehearsal and strike plan refinement as well as access to the tactical situation database, MIIDS/IDB. It will eventually interoperate with many other Navy, Marine Corps, and Air Force systems.

The Tactical Operational Preview Scene (TOP-Scene) System and the TSCM are other systems that offer support for TTPs along with the METOC systems that furnish vital weather information. Target folders supply answers to target area tactics concerns, and OOB charts developed using JMCIS provide additional input on threats.

### Mission Rehearsal Systems

Rehearsal has benefits similar to simulation, allowing the correction of defects before they become serious problems while familiarity with the system under study (i.e., the strike plan) is achieved. TOPScene is the Navy's primary mission rehearsal system. This flight-simulator-like system comes complete with joystick, head-up display overlays, SAR, IR, FLIR, night vision display, all-source mission terrain imagery, and videotape capabilities. TAMPS and TSCM are incorporating strike preview modes, which are also useful for mission rehearsal.

### Briefing Systems

Briefings are typically developed by hand using grease pencils on acetate. For the overall briefing, acetate viewgraphs are projected onto a screen in front of the CCTV camera for presentation in the ready rooms. Element briefs are typically conducted in the ready rooms and use overhead projection of acetate viewgraphs.

### O'GRADY REVISITED

At 0500 on 8 June 1995, three CH-53E Super Stallion helicopters, three AH-1W Cobra attack helicopters, and four AV-8B Harriers lifted off the USS *Kearsarge*.<sup>6</sup> Other Navy, Air Force, and Marine aircraft flying from Aviano, Italy, would join NATO aircraft to support the mission. A key component of the equipment package was a NATO Airborne Warning and Control System (AWACS) aircraft that had sufficient radar and communications capabilities to coordinate the mission and alert forces to impending threats.

CH-53Es were used instead of CH-46s because of their greater range capability. (O'Grady was believed to be 100 nmi inland.) EA-6B aircraft would detect active SAM sites and communicate with F/A-18s, which

would engage the sites with HARM missiles. The Harriers would suppress other air defenses (e.g., antiair artillery) as well as ground threats. The Super Stallions and Cobras would fly to O'Grady under this protection using terrain to mask their route as much as possible.

This equipment package would only be capable of handling small Serbian ground forces. Thus, any mechanized force within 30 minutes of O'Grady was a criterion for "no go." In case of excessive trouble, a company-sized Sparrowhawk and a second complete TRAP (tactical recovery of aircraft and personnel) force were prepared and staged aboard the *Kearsarge*. Call signs, frequencies, rules of engagement, ingress and egress routes, intelligence pictures, and return-to-force procedures were explained in a briefing before launch to raise everyone's situational awareness. A night rescue would have been preferred, but uncertainties about O'Grady's physical state, ground threats, and survival rations necessitated immediate action.

Unanticipated help came from O'Grady, who had chosen a perfect landing zone that was away from roads and the local populace and large enough for two CH-53Es. O'Grady also vectored the helicopters to his position using his survival radio and, in the final stage, a smoke canister. Almost as soon as the CH-53Es landed and Marines disembarked to establish perimeter security and prepare for their search, O'Grady, wet and caked with mud, came running from the tree line waving his 9-mm Beretta pistol. He was promptly helped aboard a CH-53E. The Marines quickly withdrew their positions, reboarded the helicopters, conducted a routine head count, and lifted off heading directly for the coastline. Total time in the landing zone was 5 minutes. On egress, the helicopters used evasive maneuvers to avoid small arms fire, antiair artillery, and SAMs; all efforts were successful and no losses were suffered.

During postmission debriefing and press conferences, O'Grady was quick to deflect his new-found hero status, indicating that the real heroes were the members of the rescue mission, a mission that began with a need for data and a disciplined approach to planning.

## THE CHANGING NATURE OF WARFIGHTING

By all accounts, the O'Grady rescue was a success. In its aftermath, however, questions have arisen regarding the nature of the rescue.<sup>6</sup> What was the most appropriate position for the commander of the marine expeditionary unit (MEU) during the rescue? Was the rescue force too extensive, posing undue risks to more troops than necessary? Did the rescue mission pose unacceptable risks to the Clinton administration's policy on Bosnia?

This line of questioning is not meant to disparage the efforts of the Marine Corps 24th MEU, who

performed heroically and commendably, having learned to make the best of the existing process and equipment. Rather, the questions are part of a broader inquiry into the ways in which the strike planning process can be improved and updated. The motivation for this inquiry comes, in part, from experience regarding the effort required to keep procedures and equipment in sync with the ever-changing nature of warfighting.

The fundamental problem solved by Navy strike planning involves the accurate placement of ordnance on target. In recent years, however, the solution has been complicated by changes in the political world, which have shifted the focus of warfighting efforts on preventing loss of life and reducing collateral damage. Warfighting has also been affected by reduced weapon inventories and personnel. Threats have changed as well; weapons are more mobile and relocatable. In addition, warfighting doctrine now emphasizes littoral regional conflicts and the nonlinear battlefield (i.e., no forward-edge-of-battle area), which is a change from the previous emphasis on blue water conflicts and Cold War-era air-land engagements.

In response to political changes, new precision-guided munitions are being developed (e.g., the Joint Direct Attack Munition and Joint Stand Off Weapon) to provide quick response, stand-off operation, and in-flight retargeting. Investments are also being made in new sensors and platforms such as the Joint Services Tactical Airborne Reconnaissance System, UAVs, and advanced tactical aircraft (e.g., Joint Strike Fighter).

Similar developments in response to changing threats and warfighting doctrine are also needed. For example, no satisfactory method exists for obtaining fire-control-quality coordinates to successfully employ precision-guided munitions against relocatable or mobile targets. Foremost among the needs created by this lack is a mechanism for timely dissemination of accurate data.

To satisfy such needs, strike planners have typically relied on technology to produce automated systems for streamlining the warfighting process. The following section offers insights into possible technological improvements to enhance the strike planning process.

## IMPROVEMENT INITIATIVES FOR THE STRIKE PLANNING PROCESS

In addition to the need to keep procedures and equipment in sync with the changing face of warfighting, attention must focus on improving the strike planning process to improve observed deficiencies. The following summarizes key improvement issues for the four primary components of the process.

### The Strike Planning Cycle

Three issues significantly affect the strike planning cycle: joint and multinational coordination, expanded

strike teams, and quick BDA feedback. To efficiently project greater power in regional conflicts throughout the world, more emphasis will be placed on coordination of joint and multinational forces. Today, such forces function relatively independently of one another. Greater levels of coordination will require continued investments in the military's C<sup>4</sup>I infrastructure.

Some targets may be destroyed most appropriately by means other than tactical aircraft. Thus, strike teams can benefit from the expertise of additional elements such as Naval surface fire support and cruise missiles. Also, UAVs can provide intelligence and support targeting without some of the risks associated with other (manned) systems such as TARPS and FLIR. Integration of these elements into the strike plan can be accomplished by placing knowledgeable staff aboard the CV or by communicating with such staff via the C<sup>4</sup>I infrastructure.

Quick BDA feedback is crucial input for restrike decisions and the efficient use of weapons. Currently, in cyclic operations, BDA from one strike is not commonly available for the immediately following strike. Efforts required to achieve quicker BDA feedback include improving sensors, sensor coverage, and data distribution mechanisms.

The networking of technologies is key to satisfying and resolving these issues. Wide-area network technology such as Challenge Athena can be used to connect disparate command centers. Local-area network technology such as Fast Ethernet and the Fiber Distributed Data Interface, which support data transmission at 100 Mbps, is available today for high-speed, fault-tolerant data sharing. Asynchronous Transfer Mode is an emerging local-area network technology with options for data transmission at 155 and 622 Mbps. Future technologies such as Gigabit Ethernet and Fibre Channel will support data transmission at speeds of 1 Gbps and higher.

### Strike Planning Functions

The efficient execution of strike planning functions is hampered by missing tools and time-consuming manual methods. Automated support tools are needed for strike coordination, management, and deconfliction—in intra-Navy multistrike environments as well as in joint and multinational efforts—to plan strategy and tactics and to avoid friendly-on-friendly conflicts. Risks must also be minimized by planning alternative courses of action. Strike team leaders need tools to streamline the consistent performance of these activities and communicate the big picture to all strike participants. Tight time lines and the increasing amount of data that influence these activities indicate that continued automated system development is needed to support these efforts. Automated algorithms are essential for the necessary

calculations, and displays (perhaps large screens with a telestrator capability i.e., capability to remotely draw or write electronically over a displayed image) are required to maximize strike plan comprehension.

The manual methods used for targetteering (TSA publications), weaponeering (hard copy version of JMEMs), kneeboard preparation (photocopies and paper cutters), briefing preparation (acetate, grease pencils, and shredders), and Special Activities Office (SAO) package and target folder storage (physical folders with no consistent standard organization technique) are time- and resource-intensive and are prone to omission. Automation via computer systems is already helping targetteering and weaponeering efforts on some platforms. Other computer systems are being developed to improve target data storage. Briefings could be streamlined by directly connecting presentation systems to the CCTV or at least via direct projection from such systems.

Technology can also streamline strike planning and execution. For instance, a voice-controlled electronic kneeboard could be connected to the aviator's head-up display. This kneeboard—as a node on a wireless network—could be remotely and quickly updated with the latest intelligence or BDA data. Aircraft data loaders might also benefit from standard technology such as PC Cards, which could dramatically reduce the size of data loaders and potentially improve their capacity. Alternatively, strike data could be downloaded to aircraft avionics systems via wireless networks, thereby eliminating the need for the physical transport device.

### The CVIC, Intelligence Gathering, and Support Functions

Of particular importance to the efficient execution of intelligence and support functions are CVIC layout and data acquisition. Each CVIC is unique. The newest one is being designed for use on the USS *Ronald Reagan* (CVN 76), which is scheduled for completion in 2003. Clearly, from the earlier discussion of strike planning and support functions, requirements for a new CVIC design must address efficient flow of people and data, reconfigurable spaces, secure spaces, virtual spaces, strike team-sized planning spaces, support team spaces, data storage, and coherent displays. The merits of extending CVIC functionality to the squadron ready rooms via communications networking must also be considered.

Server personnel in the CVIC must keep their clients' needs (e.g., quick access to intelligence data, particularly imagery) in mind so that all materials required by strike planners can be assembled quickly. Connectivity to all intelligence sources must also be highly reliable.

To keep up with the ever-increasing amount of intelligence data, the throughput requirements for effective strike planning must be continually analyzed and



the communications infrastructure must be regularly updated. Moore's Law postulates that microprocessor performance doubles every 18 months or so, yet many strike planners are using equipment that is at least 8 years old.

### Automated Support Systems

Unfortunately, most of today's mission planning systems were independently developed to assist narrow aspects of the planning process. A similar situation exists in mission planning database systems and human-computer interfaces. The result is a collection of systems that communicate poorly, represent the same data differently, and are difficult to operate. These development practices have created a great need for a unified system that will manage the use and continued development of command support systems, including those for strike planning.

In constructing such a unified system, several issues such as database updating and redundant system capabilities, compatibility, interoperability, and connectivity are vital. Many important databases are only updated quarterly and must therefore be updated manually by CV and CVW staff. Ongoing work is aimed at automatic and more frequent updates, with an on-demand database pull capability. As the amount of data grows, search engines will also be needed to accelerate the data acquisition process.

Within the Navy, systems such as TAMPS and TEAMS contain similar functions like route planning, geographic mapping displays, and access to intelligence databases. Some Air Force systems are similar to Navy systems (e.g., the Air Force Mission Support System and TAMPS, PowerScene and TOPScene, Constant Source and JMCIS, etc.). The joint services are working hard to develop sets of standards that will eventually allow most of their respective systems to interoperate. Additional collaboration on development efforts could help reduce redundancy and foster efficiency.

### CONCLUSION

The effort to construct a unified command support and strike planning system has already begun, but it will

take considerable discipline to overcome the inertia of previous development strategies. To guide the construction of such a unified system, a vision is also needed in which the operator is responsible for making decisions, not for data entry. The mission planning system should provide operators with the tools and interfaces to make decisions while relieving users of mundane and time-consuming activities that distract them from the decision-making process.

Realizing this vision will require a thorough understanding of operational and functional requirements, a thorough knowledge of end-user environments and needs, and creative use of innovative technologies in fields such as networking, communications, client/server systems, security, software, hardware, and human-computer interfaces. Wide-area network connectivity must provide fast and reliable access to worldwide data sources. High-capacity interoperable communications are needed to support the increasing use of imagery and video in a timely manner. Multilevel security systems are needed to provide efficient, yet secure, access to classified data. Computer visualization and virtual reality can improve information representation and thus increase the decision makers' level of understanding. The consistent adherence to standards in all areas of development will play an important role in achieving a unified, scalable, interoperable, plug-and-play strike planning system. This system must ensure the continued success of the Navy's strike planning efforts.

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ACKNOWLEDGMENTS: The author wishes to thank Captain Ted Spilman, USN, Commander Paul Young, USN, Edgar G. Jacques, James C. Mathers, Ann F. Pollack, and Roger O. Weiss for their valuable contributions to the work represented here. Appreciation is also expressed to the Navy personnel who were consistently generous in educating the author regarding their planning process and systems.

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