BDA Operational Analysis and FCS Impacts and Stressors

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BDA/ATR Task Team

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Abbreviations and Acronyms

AD	air defense
AOC	air operations center
ARSOCC	Army special operations component commander
ATACMS	Army Tactical Missile Systems
ATO	air tasking order
BCE	battlefield coordination element
BDA	battle damage assessment
BDE	brigade
BLOS	beyond line of sight
C^2	command and control
C^3I	command, control, communications, and intelligence
C^4I	command, control, communications, computers, and intelligence systems
C^4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CA	combat assessment
CAS	close air support
CIA	Central Intelligence Agency
CINC	Commander in Chief
CJCS	Chairman, Joint Chiefs of Staff
CNN	Cable News Network
COG	center of gravity
COP	common operating picture
DIA	Defense Intelligence Agency
DNA	Defense Nuclear Agency
DOD	U.S. Department of Defense
DP	decisive point
EEI	essential elements of information
EW	electronic warfare
FCS	Future Combat Systems
FIST	FCS Integrated Support Team
FSCL	fire support coordination line
FSCM	fire support coordinating measure
HPT	high-payoff target
HUMINT	human intelligence
HVT	high-value target
GCCS	global command and control system
IMINT	imagery intelligence
INTELINK	intelligence support network for GCCS
IO	information operations
IPB	intelligence preparation of the battlespace
ISR	intelligence, surveillance and reconnaissance
J2-T	joint intelligence staff-targeting
JC2WG	Joint Command and Control Working Group
JCS	Joint Chiefs of Staff
JFAC	joint force air component
JFACC	joint force air component commander

JFC	joint force commander
JFLCC	joint force land component commander
JFMCC	joint force maritime component commander
JFSOCC	joint force special operations component commander
JIC	Joint Intelligence Center
JIPTL	joint integrated prioritized target list
JTCB	joint targeting coordination board
JTF	joint task force
JTL	joint target list
JWAC	Joint Warfare Analysis Center
LOS	line of sight
MAAP	master air attack plan
MASINT	measurement and signature intelligence
MEA	munitions effectiveness assessment
MISREP	mission report
MLRS	Multiple Launch Rocket System
MOE	measure of effectiveness
NATO	North Atlantic Treaty Organization
NCA	National Command Authority
NLOS	non–line of sight
NMJIC	National Military Joint Intelligence Center
NSA	National Security Agency
OASD/PA	Office of the Assistant Secretary of Defense Public Affairs
RECCE	reconnaissance
RSTA	reconnaissance, surveillance, and target acquisition
SIGINT	signals intelligence
SIPRNET	Secret Internet Protocol Router Network
SOCCE	special operations command and control element
SOF	special operations forces
SQ	squadron
TBM	theater ballistic missile
TLAM	Tomahawk land-attack missile
TOC	tactical operations center
TSA	target system analysis
TST	time-sensitive target
UA	unit of action
USEUCOM	U.S. European Command
USSTRATCOM	U.S. Strategic Command
WE	wing
WMD	weapons of mass destruction

1. Introduction

> "Separate ground, sea, and air warfare is gone forever. If ever again we should be involved in war, we will fight it in all elements, with all services as one single concentrated effort."
> — Gen. Dwight D. Eisenhower

The U.S. Department of Defense (DOD) defines battle damage assessment (BDA) as

> the timely and accurate estimate of damage resulting from the application of military force, either lethal or nonlethal, against a predetermined objective. Battle damage assessment can be applied to the employment of all types of weapons systems (air, ground, naval, special forces weapon systems) throughout the range of military operations. Battle damage assessment is primarily an intelligence responsibility with required inputs and coordination from the operators. Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment. (JP 1-02)

Since BDA is a component of combat assessment (CA), it is also necessary to understand the definition of combat assessment. As defined in JP 3-60, CA is "the determination of the overall effectiveness of force employment during military operations. Combat assessment is composed of three major components: (*a*) battle damage assessment; (*b*) munitions effectiveness assessment; and (*c*) reattack recommendation."

BDA is a joint, collaborative process that is integral to all combat operations and occurs throughout all levels of warfare, from the tactical to the operational to the strategic levels. It is primarily the responsibility of the intelligence community but requires close coordination with the operations community.

To fully understand the BDA process, one must first understand the targeting process and, more specifically, the joint targeting process and how the joint targeting process supports joint operations planning and execution (Fig. 1). Since the U.S. Army will always conduct combat operations as part of a joint force, which may also include coalition forces, the joint targeting process is especially germane to understanding of how the BDA process is interwoven in the joint targeting process. The importance of this is stated in FM 60-20-10/MCRP 3-1.6.14:

> Integral to the JFC's (Joint Force Commander's) concept of operations is his concept for joint fire support and interdiction. This concept describes the integration and synchronization of joint fire support and interdiction at tactical, operational and strategic levels. Some fires support operational and tactical maneuver by land, air, and maritime forces. Other fires are independent of maneuver and orient on achieving specific operational and/or strategic objectives which support the JFC'S intent and concept of operations.

This statement is fundamental to understanding the importance of CA and BDA. The joint force commander (JFC) develops a concept of operations which includes a scheme of maneuvers, a plan for fire support, and the commander's intent. The joint targeting process occurs at all levels in the joint force by forces capable of attacking targets with both lethal and nonlethal means. The

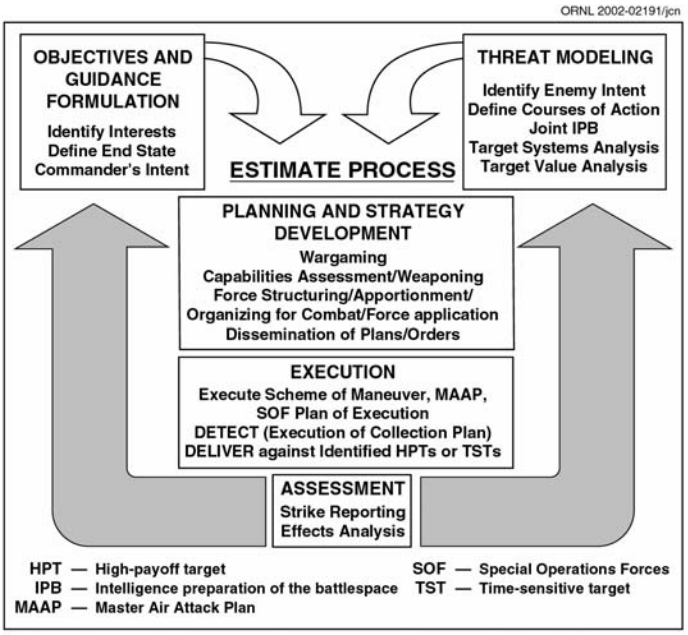

Fig. 1. Joint targeting: input to joint operations planning and execution.

joint targeting process must support the maneuver plan and the commander's intent. The JFC sets targeting objectives and targeting priorities to ensure this support. The CA/BDA process is designed to ensure that the joint targeting process is meeting the JFC'S targeting objectives and priorities. Figure 2 depicts the joint fires command and control structure.

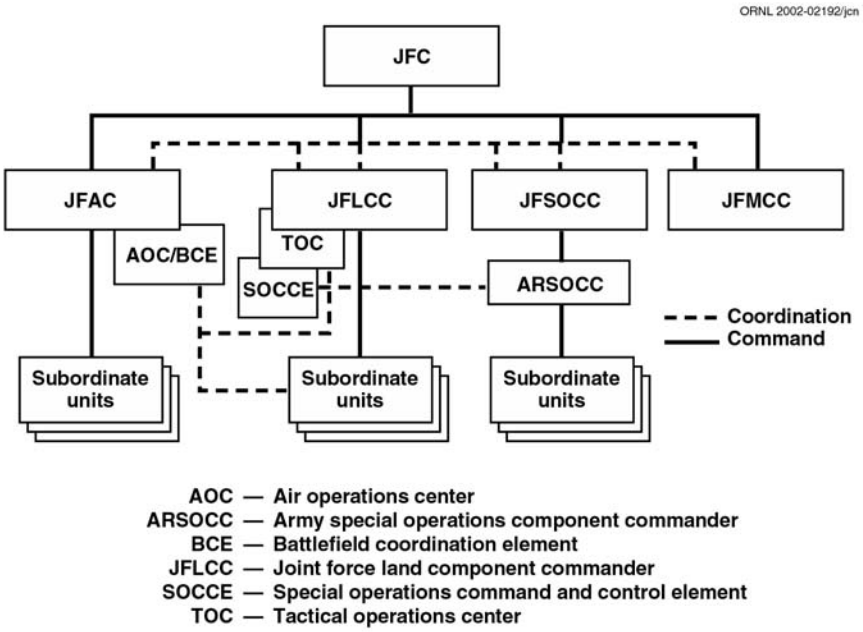

Fig. 2. National joint fires command and control structure.

2. The Joint Targeting Process

The JFC establishes campaign planning objectives, goals, and guidance for the priority and integration of joint fires. He provides guidance for the campaign as a whole, guidance for campaign phases or major operations within the campaign, and specific guidance to the component commanders in their respective roles and objectives in the campaign. Service component commanders recommend how to use their forces and combat power most effectively to achieve the campaign objectives. Given this advice, the JFC sets priorities, provides targeting guidance, sets objectives, and determines the weight of effort and supported and supporting relationships for campaign execution. After the JFC allocates resources and approves a target list, service components plan and execute assigned missions. The missions may be part of their own operations or they may be in support of other service component missions.

2.1 Control and Coordination Measures

JFCs employ various maneuver and movement control and fire support coordinating measures (FSCMs) to facilitate joint operations. These measures may include any or all of the following:

- boundaries
- phase lines
- objectives
- coordinating altitudes
- air defense (AD) areas
- amphibious objective areas
- submarine operating patrol areas
- minefields

Boundaries define surface areas to facilitate coordination and deconfliction of operations. A boundary is a line defining areas between adjacent units or formations. The JFC may use lateral, rear, and forward boundaries to define operational areas. Theater air sorties are not constrained by land boundaries. However, since the airspace above the surface is used by all components of the force, airspace control measures, to include coordinating altitudes, will be established to deconflict the uses of the required airspace. If a land force commander desires to shoot or maneuver beyond his boundaries, he must first coordinate with the appropriate commander.

2.2 Fire Support Coordinating Measures

Joint FSCMs and the procedures associated with them ensure troop safety, that other attack means are not interfered with, and that operations of adjacent subordinate units are not disrupted.

Within their operational areas, land and naval force commanders employ permissive and restrictive FSCMs to enhance

- expeditious attack of targets;
- protection of forces, populations, critical infrastructure, and sites of religious or cultural significance;
- deconfliction of fire support activities; and
- future operations.

The maneuver commander's position and adjustment of FSCMs are consistent with the following:

- the location of friendly forces,
- the concept of the operation,
- anticipated enemy actions, and
- consultation with other affected commanders.

The primary purpose of permissive measures is to facilitate the attack of targets. Permissive measures require no further detailed coordination for the engagement of targets with conventional means.

The fire support coordination line (FSCL) is a permissive FSCM. It is established and adjusted by the appropriate land force commander [the joint force land component commander (JFLCC) when designated] in consultation with other affected commanders. Forces attacking targets beyond the FSCL should inform affected commanders, time permitting, to allow them to avoid fratricide, both in the air and on the ground. FSCLs facilitate the expeditious attack of targets of opportunity beyond the FSCL.

3. The Targeting Process

> "Targeting is the intersection of intelligence and operations."
>
> — Gen. Hap Arnold, 1945

Targeting is the process of selecting and prioritizing targets and matching the appropriate response to them, taking account of operational requirements and capabilities. Targeting is a national-, joint-, and functional component-level function that selects targets and applies the necessary means to achieve the desired effects.

A target is an area, complex, installation, force, equipment, capability, function, or behavior that is identified for possible action to support the commander's objectives, guidance, and intent. A target is not critical in and of itself; rather, its importance is derived from its potential contribution to achieving the commander's military objective(s).

The joint targeting process integrates military force to achieve the JFC's objectives, guidance, and intent. With the advice of subordinate component commanders, JFCs set priorities, provide clear targeting guidance, and determine the weight of effort to be provided to various operations. Subordinate functional component commanders identify high-value targets (HVTs) and high-payoff targets for acquisition and attack, employing their forces in accordance with the JFC's guidance to achieve missions and objectives assigned by the JFC [Joint Publication (JP) 2-01.1, pp. I-1 – I-2].

The targeting process begins well before the commencement of combat operations and continues well after the end of combat operations. The targeting process is also cyclic. It follows a seven-step process:

1. guidance and priorities issued by the JFC,
2. identification of the targeting requirements (target nominations) by the service component commanders,
3. prioritization of the requirements (prioritized target list),
4. acquisition of targets or target sets,
5. attack of targets,
6. assessment of the effects of the attacks (combat assessment/BDA) by the functional components and the JFC, and
7. continued/modified guidance from the JFC.

Figure 3 shows the cycle phases of joint targeting graphically.

3.1 Information Operations

According to Joint Publication 2-01.1, information operations (IO) is "an important discipline bringing new targeting options which should be integrated and deconflicted with traditional targeting efforts."

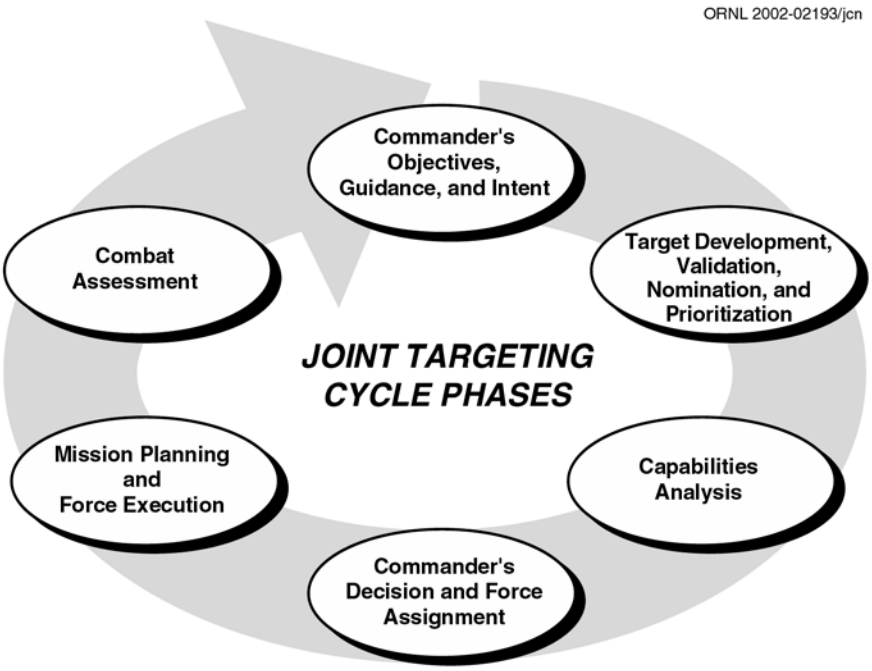

Fig. 3. Joint targeting cycle phases.

IO affects adversary decision makers, their information and information systems, and achieves or promotes specific objectives. IO is composed of five core capabilities, electronic warfare (EW), computer network operations, psychological operations, military deception, and operations security. Counterintelligence, physical attack, physical security, and information assurance are supporting capabilities to IO, while public affairs and civil affairs are capabilities closely related to IO.

Critical aspects of IO planning are the development of measures of effectiveness (MOEs) to assist in the targeting phases of IO, the utilization of the JFC's joint targeting process, and adherence to the established organizational framework for targeting operations. Failure to integrate IO and conventional target planning efforts will lead to inefficient and disjointed force application and possible delays in attaining commander's objectives (JP 2-01.1, pp. I-3 – I-4).

3.2 Fundamentals of Targeting

According to JP 3-60, "The purpose of targeting is to provide a logical progression in the development of warfighting solutions to meet the JFC's objectives." Joint forces attack targets for the purposes of capture, destruction, disruption, delay, degradation, neutralization, deception, or exploitation, commensurate with the JFC's objectives.

Within military operations, targeting must be focused on creating the desired effects to achieve the JFC's objectives or the functional component commander's supporting objectives. Targeting proceeds from the definition of the targeting problem, the desired results of the target attack, to an assessment of the results achieved by execution of the target attack.

JP 2-01.1 divides targets into two general categories: planned and immediate (Fig. 4). Planned targets are those known to exist in an operational area, with actions scheduled against them to

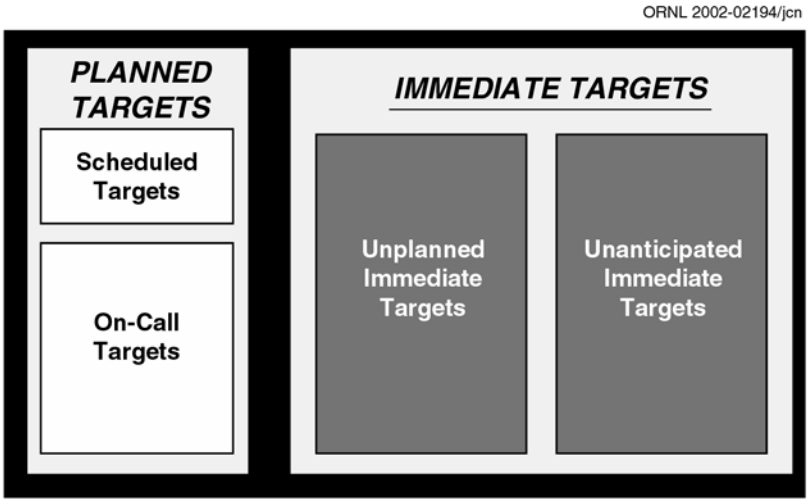

Fig. 4. General target categories and subcategories.

generate the effects desired to achieve JFC objectives. Immediate targets are those that have been identified too late to be included in the normal target planning process or develop as targeting requirements as a result of direct engagement with enemy forces. Immediate targets have two subcategories: unplanned and unanticipated.

Effective targeting is distinguished by the ability to generate the type and extent of effects necessary to facilitate the intent of the commander's objectives.

3.3 Principles of Targeting

The joint targeting process is designed to provide a means to achieve the JFC's operational objectives. For targeting to be effective, it must be focused, effects-based, interdisciplinary, and systematic.

- *Focused.* The targeting process is focused on achieving the JFC's objectives. It is the function of targeting to efficiently achieve those objectives within the parameters set by the operations plan, the rules of engagement, and the law of armed conflict. Every target nominated should in some way contribute to attaining the JFC's objectives.

- *Effects-based.* In achieving the JFC's objectives, targeting is concerned with producing specific effects. Targeting analysis considers all possible means to achieve desired effects, drawing from all available forces, weapons, and platforms. The art of targeting seeks to achieve desired effects with the least risk, time, and expenditure of resources.

- *Interdisciplinary.* Joint targeting requires the efforts of many functional disciplines. The targeting process relies upon contributions from a wide range of organizations and personnel from many disciplines. For example, operations personnel bring experience gained from the planning and execution of operations, intelligence personnel provide analysis of adversary strengths and vulnerabilities and assessment of effects on targets and target sets, and legal personnel provide expertise in the application of law of armed conflict and interpretation of rules of engagement.

- *Systematic.* In supporting the JFC's campaign objectives, the targeting process seeks to achieve effects in a systematic manner. The targeting cycle is a rational and iterative process that methodically analyzes, prioritizes, and assigns forces against adversary targets systematically to achieve the appropriate effects needed to meet the JFC's objectives. If the desired effects are not achieved, targets are recycled through the process.

Adherence to these principles throughout the targeting cycle should ensure that the desired effects are achieved while diminishing undesired or collateral consequences.

3.4 Effects-Based Targeting

Effective targeting is distinguished by the ability to identify the target options, both lethal and nonlethal, to achieve desired effects that will accomplish the JFC's objectives.

It is critical to the success of effects-based targeting to link sensors, delivery systems, and desired outcomes. The ability to rapidly collect, share, access, and manipulate information is an enabler in achieving information superiority of our adversaries. Achieving this information superiority is key to conducting effects-based targeting. Understanding the adversary's operational objectives, intentions, and decision cycle through observation and analysis enables the use of varied joint and multinational means to produce effects against the enemy's critical vulnerabilities. The targeting process must be focused on the purpose of the fires striking chosen targets.

Targeting effects are more than the results of the fires. Targeting effects are the cumulative results of the actions taken to engage geographical areas, complexes, installations, forces, equipment, functions, perception, or information by lethal and nonlethal means. Targeting effects are designed to influence the outcomes of individual battles or engagements, operations, or campaigns. Once the action is taken, the targeting process must evaluate the effectiveness of the operation. If the desired effect was not achieved, the target may need to be re-engaged or another method of attack selected to achieve the desired effect.

Targeting effects can be direct or indirect:

- *Direct effects.* Direct effects are the immediate, first-order consequences of military action, or weapons employment results, unaltered by intervening events or mechanisms. They are immediate and easily recognizable. For example, a tank is either destroyed or disabled by a direct fire engagement or direct hit from a bomb or missile, or a command center or bridge is destroyed as a result of a direct hit from a weapon.

- *Indirect effects.* Indirect effects are the delayed and/or displaced second- and third-order consequences of military action. Indirect effects are often difficult to recognize, since subtle changes in adversary behavior may hide their extent. For example, an adversary command post may cease to function as a result of nonlethal attack.

Direct and indirect effects possess three fundamental characteristics that qualitatively impact the influence they exert on an adversary's capabilities.

- *Cumulative nature of effects.* Effects tend to compound, such that the ultimate result of a finite number of direct effects is greater than the sum of their immediate consequences. Likewise, indirect effects often synergistically combine to produce greater changes than the sum of their individual consequences.

- *Cascading nature of effects.* Indirect effects can ripple through an adversary's targeted system, often influencing other targeted systems as well, most typically through nodes that are common, critical, and related to these other systems. The cascading of indirect effects usually flows from higher to lower levels of war. A simple example is the destruction of a headquarters; this destruction will have ripple effects on the subordinate units of that headquarters.

- *Collateral and additional nature of effects.* Effects often spill over to create unintended consequences, usually in the form of injury or damage to personnel or functions unrelated to the targets attacked. Sound target planning should consider the risks of unintended second- and third-order consequences. While estimating these consequences can never be an exact process, it becomes increasingly difficult as effects continue to compound and cascade through the targets and target systems.

3.5 Measures of Effectiveness (MOEs)

MOEs in military operations are defined as tools used to measure results achieved in the overall mission and execution of assigned tasks. MOEs are a prerequisite to the performance of combat assessment. Assessment of such indicators takes place at the tactical, operational, and strategic levels of war. This assessment goes far beyond counting enemy dead, bomb craters, or numbers of vehicle destroyed. The key is to determine when the predetermined conditions that affect the adversary's actions and overall strategy have been met, and whether or not the desired effects are being achieved. Continuous intelligence analysis ensures that proper combat assessment analysis takes place.

There are many different measures of effectiveness, all specific to the objectives set by the JFC. Some general examples are as follows:

- achieving the objectives of the interdiction campaign or contribution to the ground commander's objective;
- delay in the movement of adversary troops, equipment, and supplies, including reduction of tactical, operational or strategic mobility;
- disruption in the adversary's command, control, and communications;
- destruction of forces, equipment, supplies, key nodes, and capabilities;
- the adversary's own evaluation of U.S. effectiveness and capabilities; and
- synergistic effects that may be more than the combined results of the other factors.

Measures of Effectiveness

MOEs are tools used to measure results achieved in the overall mission and execution of assigned tasks. MOEs are a prerequisite to the performance of CA. All objectives should have one or more associated MOEs, which are developed during the first phases of the targeting cycle.

To be useful as a gauge of combat effectiveness, a MOE must be meaningful, reliable, and observable. A meaningful MOE must be tied to achievement of the operational and strategic objectives. A reliable MOE must accurately express the intended effect. In other words, what does a 50 percent reduction in combat potential mean in terms of the conflict's objectives? Quantitative measures must reliably convey the intended effect. An observable MOE must be measurable by existing intelligence collection methods.

— JP 2-01.1, p. II-2

4. The Joint Targeting Cycle

The six phases of the joint targeting cycle (see Fig. 3) are built upon the principles of effective joint targeting. The cycle focuses targeting options on the JFC's objectives for combat operations. The targeting cycle is not time-dependent, and steps usually occur concurrently, but the phases are a useful metric to describe the steps that must be satisfied to successfully conduct targeting:

- Phase 1 — issuance of commander's objectives, guidance, and intent
- Phase 2 — target development, validation, nomination, and prioritization
- Phase 3 — capabilities analysis
- Phase 4 — commander's decision and force assignment
- Phase 5 — mission planning and force execution
- Phase 6 — combat assessment

Understanding the joint targeting process also requires an understanding of the targeting processes of the land and air components and how they interact with the joint process. Figures 5 and 6 show the targeting processes for the land component commander and the air component commander, respectively.

4.1 Phase 1 — Commander's Objectives, Guidance and Intent

The JFC's objectives support the National Command Authority's (NCA's) desired end state for the conduct of military actions, while the guidance provided with the objectives stipulates particular conditions related to the execution of operations. Together, the objectives and guidance form the key aspects of the commander's intent for military operations. Their scope can range from very near-term tactical solutions to far-reaching campaigns in the geopolitical arena. The focus of the commander's intent is always to create a change in the adversary's behavior that turns both the tactical situation and the strategic outcomes to a U.S. advantage, thereby achieving the desired end state.

The commander's guidance drives the subsequent phase of the targeting cycle. Understanding the commander's objectives, guidance, and intent is the most important part of the joint targeting process because they form a set of outcomes relevant to the present warfighting situation and set the course for all that follows.

Effective targeting is distinguished by the ability to generate the type and extent of effects necessary to achieve the commander's objectives. Identification of centers of gravity (COGs) and decisive points (DPs) is essential to achieving the commander's objectives in accordance with guidance and intent through joint force efforts. By correctly identifying and controlling DPs, a commander can gain a marked advantage and greatly influence the outcome of the action. DPs are the keys to attacking adversary COGs. The commander designates the most important DPs as objectives and allocates resources to control, destroy, or neutralize them.

The first activity of the joint targeting process in this phase in the cycle is to translate strategy to tasks that are directly related to the overall desired outcome. These supporting tasks must then be broken down into smaller elements of sufficient clarity and weight of effort to be sustained by

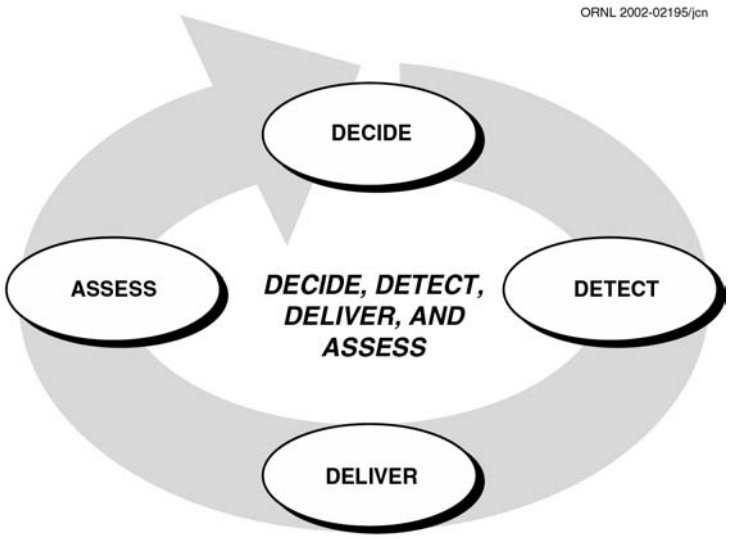

Fig. 5. Four-phase land and maritime targeting process.

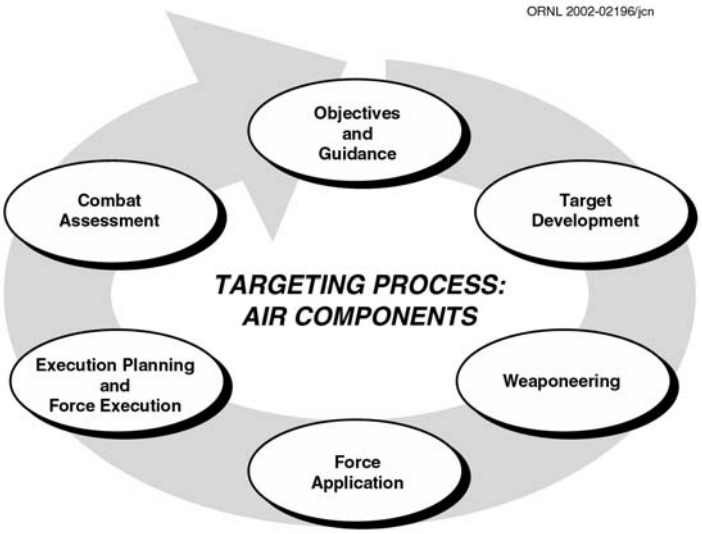

Fig. 6. Six-phase air targeting process.

joint force capabilities during the campaign. The net result of this process is to construct a synergistic structure of interrelated actions that will in totality achieve the desired outcome.

Since the basic purpose of military operations is to create change in the adversary's behavior, the other critical activity in this phase in the joint targeting cycle is the development of MOEs to assess whether objectives have been attained. These MOEs will the critical ingredient when the joint targeting process turns to the tasks of identifying specific targets and the means of attacking them, assessing the degree of success achieved in executed operations, and assisting with recommendations for follow-on military actions.

4.2 Phase 2 — Target Development, Validation, Nomination, and Prioritization

4.2.1 Overview

In the second phase of the targeting cycle, the JFC's objectives are translated into a joint integrated prioritized target list (JIPTL). It begins with target development, which entails the systematic examination of potential target systems—and their components, individual targets, and even elements of targets—to determine the necessary type and duration of the action that must be exerted on each target to generate an effect that is consistent with the commander's specific objectives. Intelligence provides the basis for the target system analysis (TSA) upon which effective target development is based. The IO target development follows the traditional methodology of identifying target systems, components, and their critical elements using a broader scope for intelligence preparation of the battlespace that accounts for information systems that might be new to the target analyst.

The expanded concept of target systems calls for an increase in the quality and fidelity of intelligence collection that pushes the targeteer's analysis and production in new directions. Integral to target development is target validation. This process determines whether a target remains a viable element of the target system and whether it is a legal target under the law of armed conflict and the rules of engagement. In this process, the potential benefit of striking a target is weighed against the potential costs. Once potential targets are identified and validated, they are nominated, through the proper channels, for approval. Targets are prioritized based on the JFC's objectives and guidance.

Understanding Intelligence, Surveillance and Reconnaissance (ISR)

Intelligence (I) products are derived from collection, processing, integration, analysis, evaluation, and interpretation of information received on the plans, intentions and capabilities of the adversary. Intelligence is normally obtained through a variety of methods, including sophisticated electronic monitoring, observation, investigation, and human informants. Surveillance (S) is the systematic observation of aerospace, surface, or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means. Finally, reconnaissance (R) is a mission undertaken by visual observation or by using other methods and resources to collect information about the hydrographic or geographic characteristics of a particular area either controlled by or of a use to the adversary.

Critical to the success of the entire targeting process is the establishment of intelligence requirements and priorities. Targeteers must work closely with intelligence collection managers to ensure that target development, pre-strike and post-strike requirements, and any changes that occur throughout the targeting cycle are integrated into the collection plan. Intelligence support is vital for the analysis required in target development, for preparing for future targeting, and for supporting post-strike combat assessment.

The JFC's objectives are normally directed against adversary capabilities and/or COGs. These are themselves enabled by physical and virtual infrastructures. It is important to understand that target development always approaches adversary capabilities from the perspective of their support from target systems. A target system is most often a collection of assets designed to perform a specific function. While target systems are intra-dependent to perform a specific function, they are also inter-dependent in support of adversary capabilities. Target development links these multiple target systems and their component targets in matrices that reflect both their

intra- and inter-dependency with tasks that contribute to the accomplishment of the commander's objectives. The analysis performed in target development must be conceived of as proceeding through successively greater levels of detail, flowing from the macro level to the micro level. This is essential to ensure the linkage between the JFC's objectives and the specific action taken against a specific target.

4.2.2 Target Development

Target development includes functions such as target analysis, documentation, and identification of collection and exploitation requirements. Target development results in four products:

1. lists of targets;
2. target folders characterizing the target and its surroundings, containing detailed analysis, relevant target materials, and modeling/simulation products;
3. collection and exploitation requirements; and
4. target briefs.

Detailed analysis should characterize the function, criticality, and vulnerabilities of each potential target and link JFC objectives to the specific action that is taken against a particular target. MOEs are then developed for judging the results of attacks. One of the keys to successful target development is to understand the relationships between and within target systems in order to uncover vulnerabilities and identify critical elements for targeting. Target analysts must include the impact of and adversary reliance on information in investigating these relationships.

Target analysis is an all-source examination of potential targets to determine their relevance to stated objectives, military importance, and priority of attack. This open-ended analytic process uses national and theater-validated requirements as a foundation. Typical products include TSA and nodal system analysis studies that are generally used as a baseline for target selection. In computer network attack planning, for example, TSA uses an expanded methodology to examine all aspects of information flow to expose interrelationships and criticality. Targeting personnel use these products to identify target systems and system components supporting JFC objectives. Planners use the results of iterative target analysis throughout the campaign and in all phases of the joint targeting cycle to update objectives, guidance, and assessments. While target analysts look at all aspects of the target system, the joint targeting process emphasizes functional system activity and components. Determining which activity must be modified or affected by friendly forces in order to achieve the objectives allows key target systems and critical components to be identified and nominated as targets.

Target analysis consists of (1) target system identification and (2) identification of target system components.

1. **Target system identification.** The first step is to identify those target system(s) that are supporting adversary activity. While a single target may be significant because of its own characteristics, the target's real importance lies in its relationship to other targets within an operational system. Target systems are usually complex, with interdependent components (see Fig. 7) and contribute to a wide variety of activities directed toward pursuit of system goals. Examples of target systems are an adversary's command, control, communication, computers, and intelligence (C^4I) structure, ground forces and facilities, and petroleum industry.
2. **Identification of target system components.** A target component is a set of targets within a target system that perform similar functions. Emphasis is shifted from the system

to the specific activities, such as industries and basic utilities involved in producing parts of an end product. The same general analytic process applies for non-industrial target systems. For example, the components of a theater's ballistic missile target system might include missile transporter erector launchers, resupply vehicles, command and control (C^2) nodes, meteorological radars, missile fuel storage sites and/or shelters, deployment areas, and the supporting road network.

When examining target system components, targeting personnel should consider the two broad categories of criticality and vulnerability (see Fig. 8).

(a) Criticality. Criticality is derived from a component's contribution to a target system's larger function and is a measure of the relative importance of components within a system. For this reason, target development focuses on identifying critical nodes within key target systems to satisfy targeting objectives as well as conformance with JFC guidance. Four factors contribute to criticality:

1. *Value* measures the system's importance to the adversary's ability to conduct operations; to the friendly force's ability to achieve a mission or objective; and as a measure of significance to the adversary. Significance is the degree of concern for an activity or resource in excess of the value assigned during its normal performance. The value measurement may reflect military, economic, political, psychological, informational, environmental, or geographic significance. Psychological significance assigned to a system reflects the thought processes of the adversary. For example, the birthplace of a political, religious, or cultural leader may fall into this category.

2. *Depth* is a measure of the time required before disruption of a component's activity affects the system output. "Average depth" is a time concept designed to measure the average interval between the time the production of an item begins and the time the finished product appears in use by a tactical unit. In general, computation of depth is important to measure the time available to the adversary to organize substitute consumption, alternate production, or procurement before the system suffers degradation.

3. *Recuperation* is a measurement of the time and cost required for a system to regain the ability to function after being disrupted. By assigning each type of target a reconstitution or recuperation time factor, such as days required to rebuild the facility or perform the original function again, the amount of target value restored each day can be estimated. The target analyst can then determine the timing or necessity for a reattack.

4. *Capacity* is defined as either current or maximum output. Current output may be represented by plant production based on the present labor force, the economy of the country, the current demand for the product, and demonstrated production over the past two or three years. Maximum output may be represented by full-capacity production based upon existing equipment and continuous operation over a 24-hour day.

(b) Vulnerability. The vulnerability of a target, installation, or facility refers to its physical susceptibility to damage or disruption. The size and types of force required to damage or disrupt a target, as well as munitions and fuzing requirements, are based on its vulnerability. Six characteristics contribute to a target's vulnerability:

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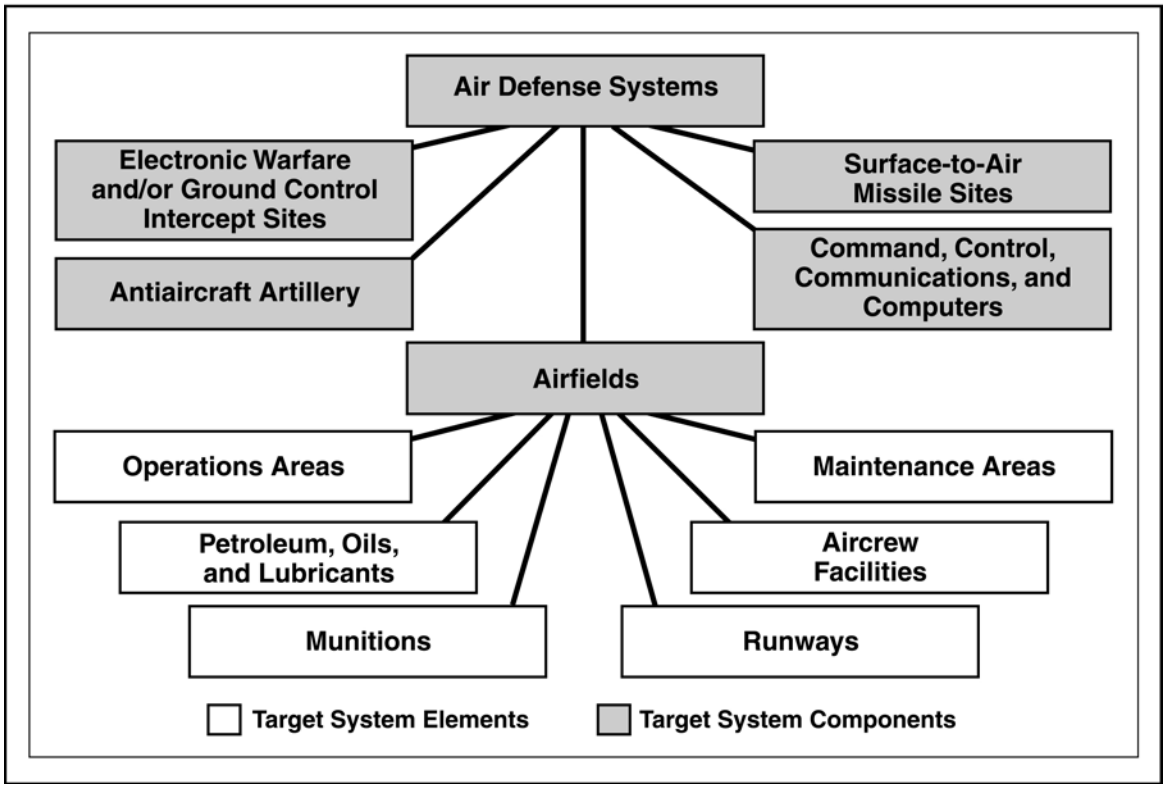

Fig. 7. Target system components and elements.

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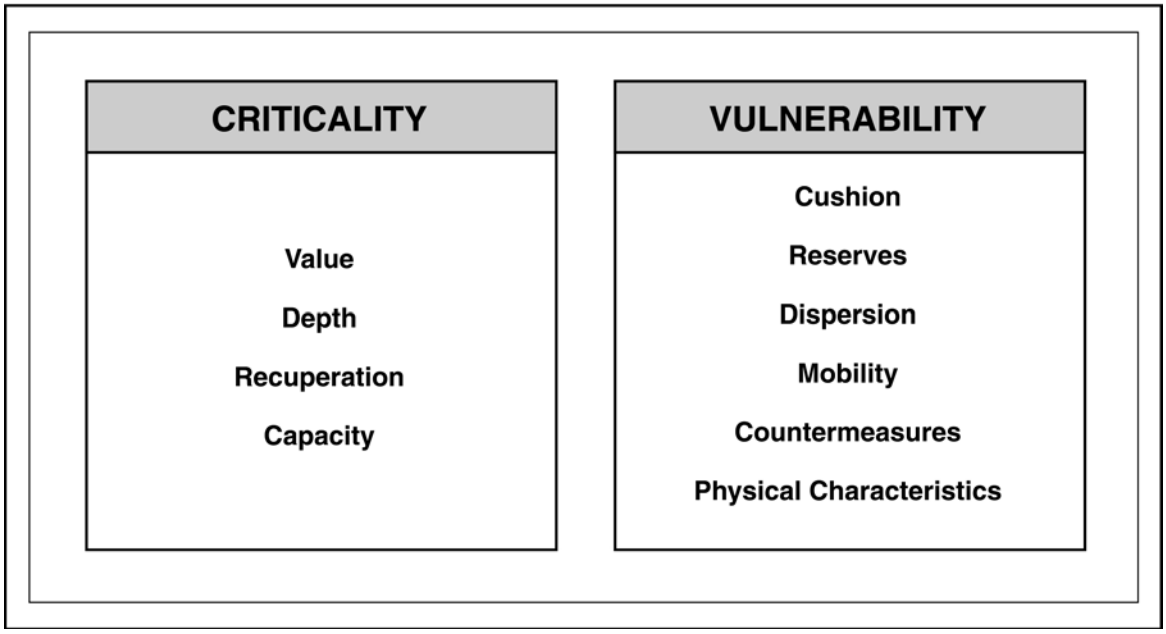

Fig. 8. Factors in target selection.

1. *Cushion* is a measure of the extent to which a single component or system can absorb a disruptive influence and continue to produce or provide the required product or service. Viewed from another angle, cushion is that portion of the adversary's system which must be affected in order to achieve desired outcomes. Determining this point for an industry or a military activity requires detailed analysis of a system's operation, including idle plant capacity, replacement substitution and expansion capacity, civilian production use, the production of nonessential military items or services, and production or provision of substitute materials or services.

2. *Reserves* provide a quantity of stored resources the adversary may use when the normal supply of the resource is disrupted. Assessment of reserves depends upon the estimation of the system use or flow rate. The measure of reserves is the percentage of the products used versus the total products available.

3. *Dispersion* is the geographic distribution of either the installations in a target system or target elements within a target complex. An installation with a large number of dispersed elements presents a more difficult targeting problem than does a tightly concentrated installation. Alternatively, dispersion may degrade the adversary's capabilities by making his own operations more complex.

4. *Mobility* is a measure of the time required to shift a target component activity from one location to another. Mobility affects both the perishability of the information about the location of the adversary system and the ability of friendly systems to detect, locate, identify, and strike the target component.

5. *Countermeasures* are a measure of an adversary's ability to counteract the potential disruptive activity of the friendly system through active and passive means. An adversary's effective use of terrain, camouflage, emission controls, passive defenses (caves), and active defenses could negate the ability of the friendly system to exert an influence upon adversary component activity.

6. *Physical characteristics* are analyzed to determine the target's susceptibility to kinetic damage. These include such elements as weight, shape, volume, construction, and sturdiness.

4.2.3 Target Validation

Integral to target development is target validation. Target validation determines whether a target remains a viable element of the target system. Equally important is determining whether the target is a lawful target under the law of armed conflict as promulgated under the rules of engagement.

Target validation that ensures all targets meet the objectives and criteria outlined in the commander's guidance (see Fig. 9). Certain questions should be considered during target validation:

1. Does the target contribute to achieving one or more JFC objectives or supporting subtasks?
2. Does the target comply with JFC guidance and intent? Is the target a lawful target? What are the considerations under the law of armed conflict as promulgated under the rules of engagement?

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Fig. 9. Factors to consider in target validation.

3. Does the target contribute to the adversary's capability and will to wage war?
4. Is the target operational?
5. Are there any facilities or targets collocated with no-strike or restricted facilities?
6. What is the relative potential for collateral damage or collateral effects, including casualties? Consider collateral damage concerns in relation to the law of armed conflict, the rules of engagement, and the commander's guidance.
7. What psychological impact will operations against the target have on the adversary? On friendly forces or coalition partners?
8. What would be the impact of not conducting operations against the target?
9. Is the target environmentally sensitive or likely to generate environmental impacts?

Once potential targets are identified and validated, they are nominated through the proper channels for approval. Targets are prioritized on the basis of the JFC's objectives and guidance and the mutual support required between joint force components as they strive to achieve the JFC's objectives. The net result of this phase of the targeting process is the production of the approved targets in a target nomination list that identifies those elements within an adversary's power base that most closely support the JFC's objectives and that has been vetted through all joint force component and interagency concerns. In addition to enumerating these candidate

targets, the nomination list also includes specific functional outcomes that must be created at each target to achieve the JFC's objectives. This supporting documentation is critical in order to frame the force estimation performed in the next phase and to facilitate the assessment of success achieved.

4.2.4 Target Nomination

The joint target list (JTL) is a consolidated list of selected targets considered to have military significance in a combatant commander's area of responsibility. National agencies, the combatant commander's staff, joint forces subordinate to the combatant commander, supporting unified commands, and components all nominate targets to the combatant commander for validation and approval. (In some cases, national-level approval is required.) Component commanders, national agencies, supporting commands, and/or the JFC staff submit their target nomination lists for inclusion on the joint integrated prioritized target list (JIPTL) to support JFC objectives, associated subordinate tasks, and priorities. Target nomination lists are submitted to the JFC targeting representative. Once compiled, the draft JIPTL is normally forwarded to the joint targeting coordination board (JTCB) for coordination and final approval by the JFC. After the list is approved, it is transmitted to components and appropriate agencies as the daily JIPTL. The JTCB may meet daily or as often as required. Targets are also vetted against the no-strike list and the restricted target list at each successive level. Relief may be requested from the JFC for targets nominated to the JIPTL that are also on the restricted target list. When national-level restrictions are imposed, approval from the Secretary of Defense or the President is needed, and a specific process is followed.

4.2.5 Target Prioritization

Targets on the JIPTL are prioritized on the basis of the JFC's objectives and guidance and the mutual support required between the joint force components. Once the JIPTL is consolidated, prioritized, and deconflicted, it must be approved by the JFC or his designated representative before the component commanders can use it to prepare their plans and orders. Intelligence supports this process by ensuring that target information is complete and accurate, that targets are clearly related to objectives, and that the selection rationale is clear and detailed. This may include specifying which targets must be attacked as integrated targets (as sets or individually), which must be struck in sequence, and which pose potential collateral damage concerns.

4.2.6 Considerations for Information Operations (IO) Target Development

The fundamentals of IO target development do not differ from those of traditional target development. The traditional methodology of identifying target systems, components, and their critical elements remains valid. However, there is a widening of the scope of joint intelligence preparation of the battlespace to take information processing systems into account. This expansion of the traditional concept of target systems requires an increase in the quantity and fidelity of intelligence collection. There is an additional requirement for technical and analytical expertise.

Long lead times are usually required to fulfill IO-related collection requirements. Target analysts must work to associate computer network attack capabilities with potential target vulnerabilities and determine information gaps for those targets as early as possible. Furthermore, because of intense competition for scarce intelligence collection resources, stove-piped intelligence operations must be minimized and full data sharing must be coordinated among target analysts and planners working on these target sets.

Effective analysis of target systems will discern all the dimensions of an adversary's information systems and their interrelations. System dimensions include human factors, communications architecture, network topology, and information flow and functionality, among other factors. Target intelligence specialists must seek to include these interrelated elements when analyzing processes and systems in order to identify their critical elements.

4.3 Phase 3 — Capabilities Analysis

Concurrent with the determination of targets and desired outcomes for those targets is the selection of the most capable forces for application against those targets. This phase of the joint targeting cycle involves estimating the effects of lethal and nonlethal attacks against specific targets. Its purpose is to weigh the relative efficacy of the available forces as a means to achieving the objectives set forth by the JFC and subordinate commanders. These estimates build upon the analysis performed in target development, both for information that characterizes the physical, functional, and psychological vulnerability of the target and for the connecting thread of logic to the JFC's objectives and guidance. Estimates may be generated using mathematical models that take into account the target's critical vulnerabilities, performance data on the weapons and weapons platforms contemplated for application against the target, and the delivery parameters associated with the delivery of those weapons. It is critical to stress that all estimates generated during this phase are situation-specific, reflecting the pairing of particular forces (and weapons and weapon systems) against particular targets, under particular conditions of employment.

Once the capabilities analysis phase is completed, the results can be merged with the individual service component target nominations to create the target recommendations for the JFC. The critical element of this phase of the joint targeting cycle is to link anticipated effects to the JFC's objectives.

4.4 Phase 4 — Commander's Decision and Force Assignment

Target nomination lists and associated forces are vetted, through the appropriate coordinating bodies representing the joint force components, to ensure compliance with the commander's objectives, guidance, and intent and the synergistic application of effort with minimal operational conflict. Upon JFC approval, this approved target list becomes the JIPTL.

The next step is the preparation of tasking orders and release to executing functional components and forces. The joint targeting process facilitates the publication of tasking orders by providing amplifying information necessary for detailed force-level planning of attack operations.

4.5 Phase 5 – Mission Planning and Force Execution

After tasking orders are received, detailed planning must be performed for the execution of operations. The joint targeting process supports this planning by providing tactical-level planners with direct access to detailed information on targets, supported by the nominating service component's analytical reasoning that linked the target with the desired effect. This will provide the background information necessary for the warfighter to focus on the JFC's objectives as the battle unfolds.

4.6 Phase 6 — Combat Assessment

Effective campaign planning and execution require a continuing evaluation of the impact of combat operations on the overall campaign. Combat assessment (CA) evaluates combat operations effectiveness in achieving the JFC's objectives and recommends changes in tactics,

strategies, objectives, and guidance. The military end state is directly linked with CA. CA compares the results of the operation to the objectives to determine mission success or failure within the guidance parameters. More important than just a review, it looks forward to determine if additional missions are needed and/or if modifications to the objectives are necessary.

CA is performed at all levels as an all-source, joint program supported by all components of the joint force and designed to determine if the required effects on the adversary in the campaign plan are being achieved. CA directly impacts the JFC's air apportionment decision. The end product of CA at the operational and/or strategic level is a campaign assessment that is incorporated into strategy and guidance development or refinement.

> Combat assessment is a critical part of combat operations. A complete understanding of all aspects of target development and its link to the JFC's objectives, guidance, and intent is a necessary ingredient for effective CA. Composed of three interrelated processes (battle damage assessment, munitions effectiveness assessment, and future targeting or reattack recommendations), CA is a continuous, dynamic process that drives current and future targeting decisions.

CA is a continuous, dynamic process that drives current and future targeting decisions. The JFC, his staff, and the functional component staffs continuously evaluate the results of operations and provide these to the JFC for the overall evaluation of the current operation or campaign plan. They must take into consideration the capabilities and forces employed, munitions, and attack timing in assessing the specific mission and operations success and effects against the specific targets attacked, target systems, objectives, and remaining adversary warfighting capabilities, relative to the JFC's objectives, guidance, and intent. Future adversary courses of action and remaining combat capabilities must also be weighed against the JFC objectives, guidance, and intent to determine future targeting objectives and recommended changes in the courses of action. Although CA is listed as the end of the joint targeting process, it provides the inputs for the reinitiation of the process and subsequent target development, weaponeering, force application, force execution, and subsequent combat assessment.

CA is composed of three interrelated components: battle damage assessment (BDA), munitions effectiveness assessment (MEA), and future targeting or reattack recommendations (Figs. 10–11). One of the most common mistakes made is to confuse BDA and CA. BDA is a familiar term with historical roots and tends to overshadow the CA process. BDA is intelligence-driven, while CA is the responsibility of the commander. BDA focuses on damage to the target and target system, while CA is much broader and tries to answer the question, "How well are we doing and what's next?" Like BDA, CA provides information to commanders, battle staffs, and planners. All too often the focus is on BDA, with CA an afterthought.

Measures of merit should be developed for all campaign objectives during the planning phase and refined in the target development process. Intelligence is key to determining when objectives have been attained so that joint force may be reoriented or operations terminated. Intelligence evaluates military operations by assessing their effect on the adversary's situation and capabilities with respect to the JFC's objectives, guidance, and intent. CA strives to analyze what is known about the damage inflicted on the enemy to determine what physical attrition the adversary has suffered, what effect the efforts have had on the adversary's plans and capabilities, and what, if any, changes need to be made to the JFC's campaign plan. CA requires constant information and intelligence flow from all sources. The same basic information and intelligence is required for all components of CA. The information and intelligence required for mission assessment is similar to, and in many instances, the same as, that collected for BDA and MEA. An intelligence

collection plan, tailored essential elements of information (EEI), and the objectives' measures of merit are required to conduct CA. The JFC apportions joint force intelligence, surveillance, and reconnaissance (ISR) assets to support the CA intelligence requirements. In order for the joint targeting process to be effective, the intelligence collection plan and the target development process must be closely coordinated.

The lynchpin to CA is the integrated coordination between the target development process and the ISR collection plan. CA examines lethal and nonlethal attack to determine the effectiveness of operations in meeting the JFC's objectives, guidance, and intent. CA provides information to commanders, battle staffs, planners, and other decision makers. CA is focused on effectiveness, not efficiency; it is the commander's purview to determine efficiency.

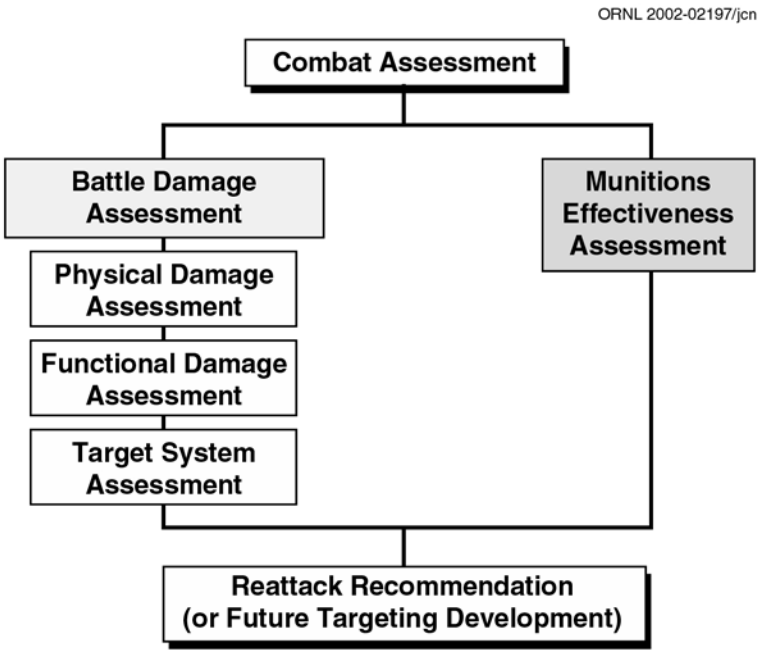


Fig. 10. The combat assessment process.

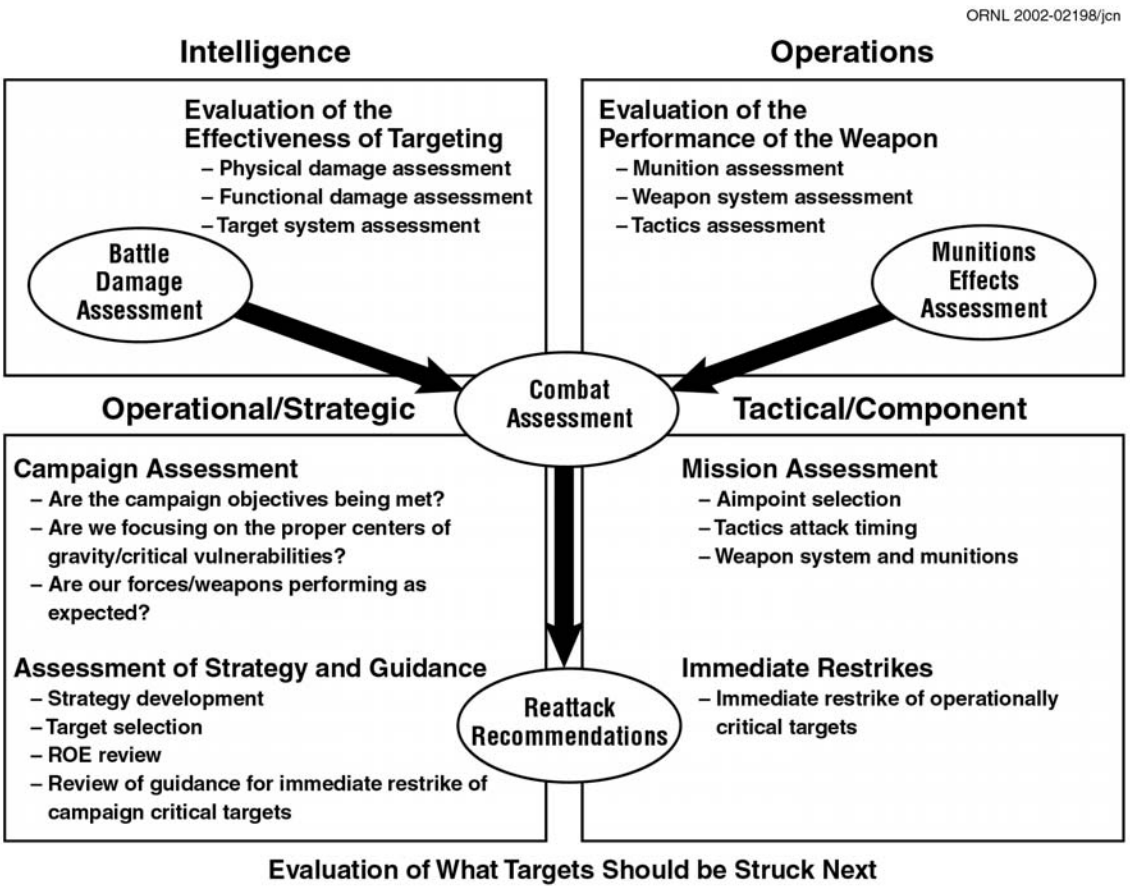


Fig. 11. The components of combat assessment.

5. The Three Components of Combat Assessment

As noted in the previous section, CA is composed of three processes: battle damage assessment (BDA), munitions effectiveness assessment (MEA), and future targeting of reattack recommendations. Each of these in turn is discussed below.

5.1 Battle Damage Assessment

BDA is the complementary activity to the selection of targets performed in target development. It uses a three-phased approach to proceed from a micro-level examination of the damage or effect inflicted on a specific target, to ultimately arriving at macro-level conclusions regarding the functional outcomes created in the targeted system—in effect retracing the macro-to-micro path of target development in reverse. To conduct BDA in the three-phased approach, a baseline set of target system damage criteria and MOEs must be established. These criteria and measures are invaluable to maintaining a standard measure of targeting effectiveness. They help drive the conduct of military operations against target systems in a more effective, systematic fashion.

The first phase of BDA is physical damage assessment. It examines the outcomes at the specific targeted elements. Functional damage assessment, the second phase, estimates the functional consequences for the target system components. In the third and final phase of BDA—target system assessment—analysis projects the results on the overall functioning of the target system and the consequent changes in the adversary's behavior. The purpose of BDA is to compare what was actually accomplished to what target development determined should be accomplished when the targeting options were being formulated. Consequently, a critical ingredient of effective BDA is detailed familiarity with all aspects of the analysis performed in the target development that justified the chosen targets and their linkage to the JFC's objectives, guidance, and intent.

5.1.1 Phase 1 BDA — Physical Damage Assessment

Physical damage assessments estimate the quantitative extent of physical damage (through munitions blast, fragmentation, and/or fire damage effects) to a target resulting from the application of military force. This assessment is based upon observed or interpreted damage. Physical damage definitions narrow the choices the analyst uses to describe the level of damage and are unique to the specific type of target being analyzed. This allows information to be relayed quickly and accurately. Figure 12 depicts the information flow in Phase 1 of the BDA.

Key factors in determining the extent of physical damage assessment are the following:

- *Target type and size.* Was the attacked target or system element a piece of equipment or a building or a bunker? How hard is the target? How big is the target?
- *Warhead/weapon type and size.* Did the weapon used against the target or system element have a general-purpose, shaped-charge, penetrator, or submunition warhead? How big (weight) was the warhead?
- *Warhead/weapon detonation location.* Did the weapon detonate on, above, or outside the target? Did the weapon detonate upon impacting the target? Did the weapon detonate inside the target? If so, where?

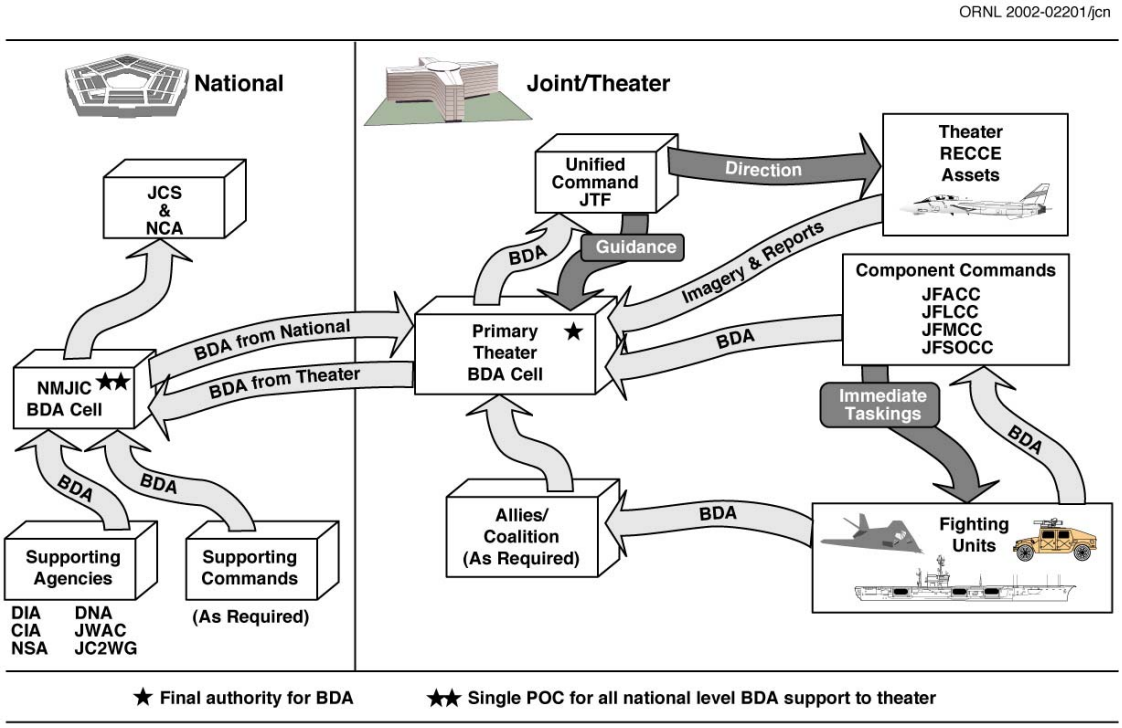


Fig. 12. Phase 1 BDA information flow: initial physical damage assessment

Physical damage assessments can be inductive (using sensors or crews to directly observe damage) or deductive (using indirect means to ascertain damage results). Examples of inductive observation could involve secondary explosions seen by crews or cessation of movement after attacks. Damage can be deduced if it is unobserved by verified third-party sources. Indirect bomb damage can also be inferred from the miss distance (the distance between weapon detonation and the target). A measure of the success of the attack is the impact on the activity the adversary is performing through the target system.

To quantify physical damage, the assessment is conducted against one or more specific aimpoint(s), usually containing a critical element. Destruction of an entire building may not be required if the stated objective is to destroy a specific portion of the building based on the function (critical element) contained within that section of the building. Assessments of “no damage” and “destroyed” are easily defined and understandable. The difficulty is judgment calls specifying the level of damage between these two extremes.

Intermediate damage definitions are dependent on target type and the ease of assessing damage. For example, in buildings, “light,” “moderate,” and “severe” damage is determined by the percentage of the target area (building) damaged. Likewise, runways have specific categories that include “cratered,” “cut,” and “interdicted.” In contrast, when assessing armored vehicles, only the “damaged” category is used. In assessing physical damage, assessors must consider whether camouflage, concealment, and deception techniques may have been used by the adversary to either minimize or amplify the extent of physical damage, which may distort the assessment.

In determining the level of physical damage, a confidence level is assigned to indicate the assurance of the assessment. The three terms used to identify confidence are "confirmed," "probable," and "possible."

Collateral damage is also assessed and reported during BDA. Collateral damage is defined as unintentional or incidental damage affecting facilities, equipment, or personnel as a result of military actions directed against targeted adversary forces of facilities.

Initial reports are often based primarily on visual observation of the target and are usually derived from a single source. Further analysis continues with all-source reporting, resulting in further supplemental reports. Inputs come from aircrew mission reports (MISREPs) and debriefs, weapon system video, manned and unmanned imagery reconnaissance, and other sources. The unit controlling the weapons system, as well as intelligence collection units that can see the damage, develop Phase 1 BDA reports. These Phase 1 reports are usually the first indicator of problems with weapons systems or tactics assessed during MEA.

5.1.2 Phase 2 BDA – Functional Damage Assessment

Phase 2 BDA reviews all Phase 1 damage assessments and amplifies the initial analysis. Functional damage assessment estimates the effect of military force on degrading and/or destroying the functional or operational capability of the target to perform its intended mission. The level of success is based upon the operational objectives established against the target. Phase 2 draws on all-source intelligence and operational data to determine functional damage to a target and an estimate of impact on the target system. Figure 13 depicts the information flow in Phase 2 of the BDA.

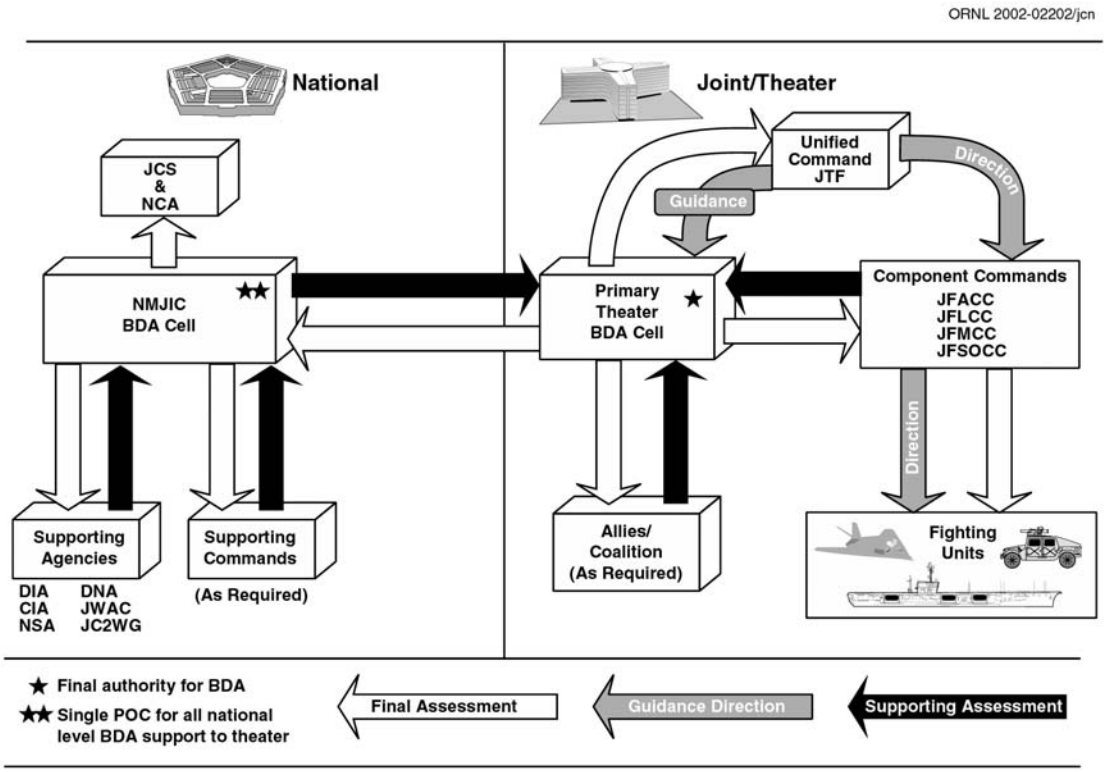


Fig. 13. Phase 2 BDA information flow: all-source functional damage assessment.

A key step in functional damage assessment is identifying and establishing the installation's or target's critical elements and their interconnectivity. A critical element is defined as one which, if destroyed or not operating, will prevent the installation, target, or target system from functioning. Additionally, the target's "normal" level of operation must be quantified. If it is an industrial target, what does it produce? If it is a military installation or node, what is its basic purpose? Without these preattack assessments, wartime functional damage assessments may be inadequately assessed. Ideally, BDA will be performed by or with the input of the targeteer who originally targeted the facility, installation, equipment, or target system.

An estimate of the recuperation time required for the enemy to repair or reconstitute should always be part of a Phase 2 report. This time (expressed in hours, days, etc.) is an estimate based upon the type, degree, and location of the physical damage. The availability of spares, backup, or alternate replacement functions, the operational tempo and expected duration of the hostilities, and the adversary's determination and capability to repair or replace are all factors used to calculate recuperation times. This phase requires the integration of theater and national source information. The theater Joint Intelligence Center (JIC) has access to these intelligence sources and provides significant support to this process. Signals intelligence (SIGINT), imagery intelligence (IMINT), and measurement and signature intelligence (MASINT) sources are key to assessment during this phase.

Although the Phase 2 BDA is a qualitative assessment, the rules of scientific inference can still be applied to reduce the errors inherent in this phase. The goal is to explain as much as possible with the limited information available. The rules of scientific inference include

- defining the variables (identifying critical elements and predicting weapons effects),
- improving data (using all-source intelligence, and recording and reporting the source of the information/intelligence), and
- improving the use of the data (sharing and disseminating information/intelligence, and identifying additional information/intelligence requirements).

This method of inference facilitates identification of any bias associated with a particular source. It also increases both the reliability and the validity of the assessment—the reliability, by applying the same procedure the same way in order to increase the likelihood that an independent assessment will arrive at the same conclusion; and the validity, by increasing the likelihood of that the assessment is "correct" (i.e., that the implications and variables being analyzed are in fact true indicators of the function being analyzed). This method requires accurately documenting how the assessment was arrived at, as well as providing a level of certainty and confidence level of the assessment.

Determining applicable indicators and collection plans ahead of time is crucial to timely Phase 2 assessments, especially if the damage cannot be directly observed.

5.1.3 Phase 3 BDA – Target System Assessment

Phase 3 BDA produces a target system assessment for the theater of operations. Subject matter experts compile the functional damage assessments of the individual targets within a system and apply them to the current system analysis or order of battle. The resulting assessment provides the JFC with an estimate of the remaining capabilities of the targeted system, supports CA in determining whether campaign objectives are being met, and assists in determining how successful efforts have been to degrade the adversary's warfighting capability or deprive the

adversary of that capability. Figure 14 depicts the information flow in Phase 3 of the BDA. Although different weapons are involved, the process described above applies to BDA of targets attacked with nonlethal fires as well. SIGINT will often be the most capable collection asset in determining the actual functional damage to the target in these cases.

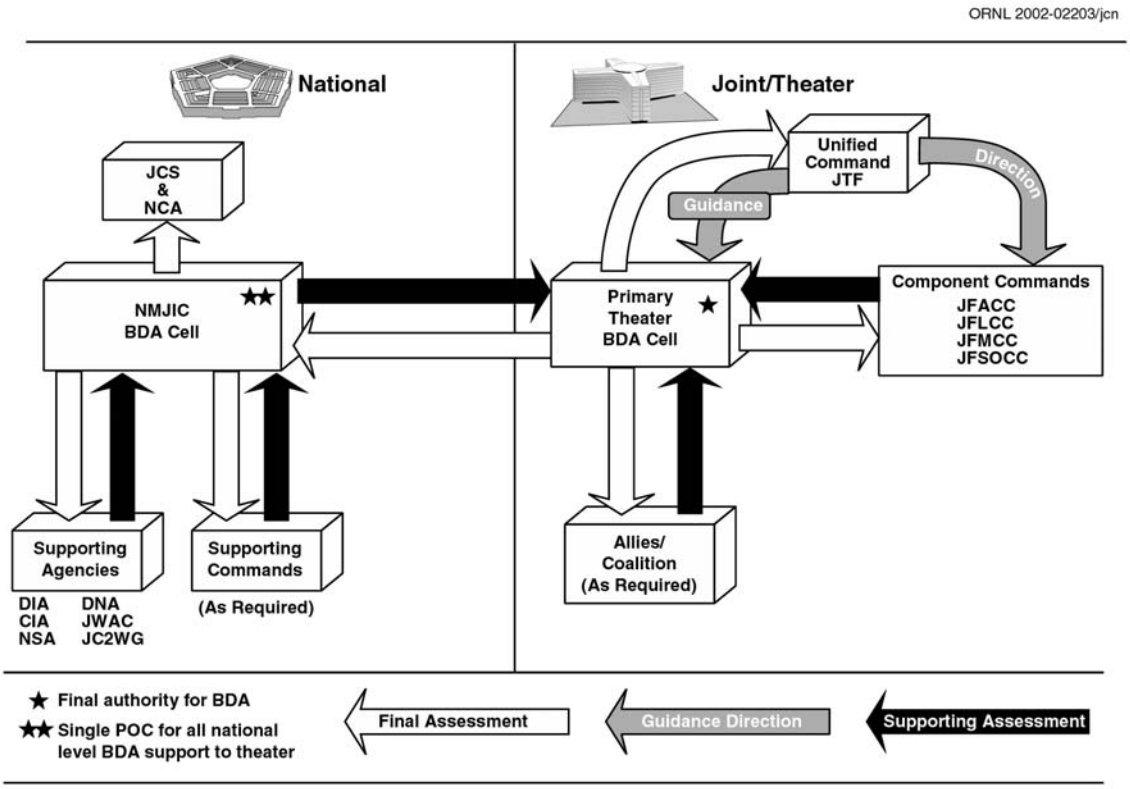


Fig. 14. Phase 3 BDA information flow: target system assessment.

5.2 Munitions Effectiveness Assessment

MEA is the corresponding activity to BDA and involves after-the-fact analysis of how munitions performed and the method by which they were applied. It complements the estimative analyses of capability assessment by examining the forensic evidence after attacks to determine whether weapon systems performed as expected. The purpose of MEA is to compare the *actual* effectiveness of the means employed to their anticipated effectiveness as calculated during the capability assessment phase of the joint targeting process. The results of the MEA support both near-term improvement in force employment tactics and techniques and long-term improvements in lethal and nonlethal capabilities. Consequently, a critical ingredient for effective MEA is detailed familiarity with all inputs to the calculations performed in capability assessment that resulted in weapon system selection.

5.3 Future Target Nominations and Reattack Recommendations

Future target nominations and reattack recommendations merge the picture of what was done (BDA) with how it was done (MEA) and compares the result with predetermined measures of effectiveness (MOEs) that were developed at the start of the joint targeting process. The purpose

of this phase in the process is to determine the degree of success in achieving the JFC's objectives, guidance, and intent and to formulate any required follow-up actions, or to indicate readiness to move on to new tasks along the path to achieving the overall JFC campaign objectives. This last activity in CA both completes and begins the joint targeting process anew by linking the achieved outcomes with stated objectives that began the cycle.

6. Post-Campaign and Operation Activities

The joint targeting process does not end when hostilities cease. During the transition phase of post-conflict operations there is normally a critical need to collect all available information and intelligence that feeds both the BDA and MEA analysis. This data collection is essential to

- evaluate the full extent of target physical and functional damage,
- determine the true effectiveness of employed delivery systems and munitions, and
- critique and improve the BDA analysis and reporting process.

Although many different types of data are collected for follow-on analyses, generally they fall into the areas of operational data, intelligence data, and MEA exploitation. The goal of these "ground truth" operations is to bridge the gap of knowledge that exists between the level of damage the BDA collection assets have shown during hostilities and what actual physical and functional damage was done to the adversary targets and systems.

7. The Land Component Targeting Process

A joint force land component commander (JFLCC) follows the "decide, detect, deliver, assess" targeting process (see Fig. 5, above) to provide input to the joint targeting process. However, the JFLCC is focused on the following:

- influencing interdiction operations to shape or influence the adversary before adversary forces or capabilities can be brought to bear on his forces in his battlespace;
- isolating his subordinate commanders' battlespace in accordance with the scheme of maneuver;
- providing his subordinate commanders with the necessary battlespace to conduct operations; and
- providing his subordinate commanders with the assets to support their needs for target acquisition and required attack systems.

The JFLCC's role in targeting is more a planning and assessment role than one of execution. His execution focus is primarily between the FSCL and the forward boundary of his area of operations. Tasks in this area are predominantly focused on counter-air, interdiction, strategic attack, and intelligence gathering.

The JFC and JFLCC are challenged to develop and implement procedures to plan, coordinate, and execute operations in the area between the FSCL and the forward boundary. These challenges include

- establishing joint targeting procedures that facilitate the nomination and integration of JFLCC priority targets into the JFC joint attack plan;
- as the JFACC integrates target nominations into the overall theater interdiction effort, ensuring that the supporting air interdiction in the JFLCC area of operations meets the JFLCC targeting objectives;
- establishing sensor-to-shooter links that support command and control requirements for target acquisition and attack throughout the JFC area of responsibility and that eliminate the possibility of creating sanctuaries for adversary forces;
- designation, timing of execution, and shifts of the FCSL; and
- ensuring that the JFACC air apportionment meets the JFC's objectives and the JFLCC's targeting requirements.

The apportionment and allocation process is key to synchronizing maneuvers, fires, and interdiction in the JFLCC area of operations. Apportionment is the assignment by percentage and/or priority of the total resources that can be devoted to air operations and/or geographic operations for a given time period. The total resources made available to the JFACC are determined by the JFC in consultation with component commanders on the basis of assigned objectives and the concept of operations. JFCs normally apportion by priority or percentage available to geographic areas against mission-type orders and/or by categories significant for the campaign. These categories usually include strategic attack, interdiction, counter-air, maritime support, and close air support (CAS).

After consulting with other functional component commanders, the JFACC makes an apportionment recommendation to the JFC. Following the JFC's apportionment decision, the

JFACC allocates apportioned air sorties to the functions, areas, and/or missions they support. The JFACC then publishes the total available sorties available for a given time period and the percentage of allocation by mission, function, or geographic area.

CAS allocation is of particular interest to the JFLCC because these sorties are required by the JFLCC subordinate commanders to execute their assigned missions and concepts of operation in their designated battlespace, usually between their rear boundary and the FSCL. Interdiction sorties allocated for use forward of the FSCL and within the JFLCC area of operations (boundary) are important because they are necessary for the JFLCC to shape and influence the adversary before adversary forces are able to affect the battlespace of his subordinate commanders. The JFLCC is also concerned with the sorties allocated to strategic attack as they affect the national level of command and control of adversary forces; the shapes and influences of adversary forces well before introduction into the JFLCC area of operations; and the attack of the adversary's overall war-making capabilities.

Figure 15 is a schematic of the integrated air and ground operations and targeting planning process; Fig. 16 is a notional depiction of the division of targeting responsibility between the joint headquarters and the service component headquarters.

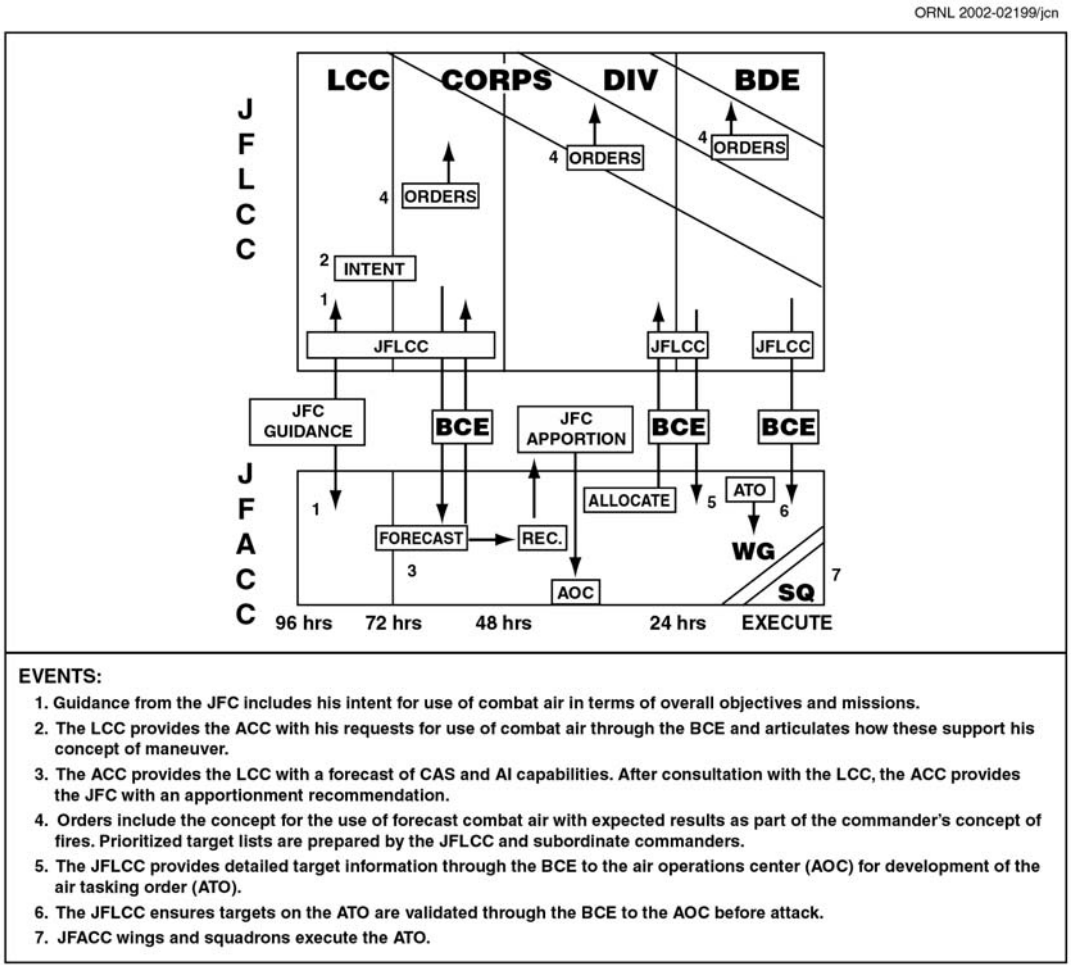


Fig. 15. Integrated air and ground operations planning process.

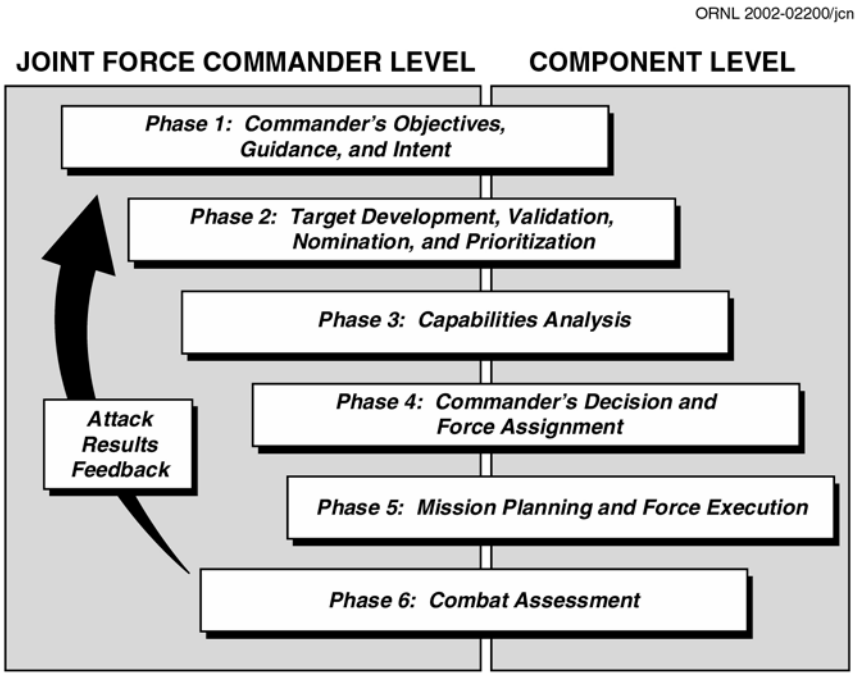


Fig. 16. Notional relative division of joint targeting process responsibilities.

8. Time-Sensitive Target (TST) Considerations

Time-sensitive targets (TSTs) are those of such high priority to friendly forces that the JFC designates them as requiring immediate response. TSTs pose, or will soon pose, a danger to friendly forces, or they are highly lucrative, fleeting targets of opportunity. The JFC normally provides specific guidance and prioritization for TSTs within the operational area. TSTs such as airborne aircraft and missiles may be handled by direct tasking of functional components. Other TSTs may require detailed interservice and/or functional component planning and coordination. The presence of TSTs in the battlespace requires the JFC to address functions and responsibilities in addition to those previously discussed.

8.1 JFC Responsibilities in TST Operations

The JFC's objectives and guidance set the basic procedural framework for the functional components to expedite the targeting of TSTs. The JFC establishes a priority for TSTs for immediate response. In addition, the JFC establishes guidance on procedures for coordination, deconfliction, and synchronization among functional and/or service components in a theater of operations. Once this guidance is set forth, the components establish planned and reactive procedures for attacking the prioritized TSTs. JFC guidance for TSTs supports different phases of the joint targeting process and includes the following:

- Establishing planned and deconflicted fire support control measures against specific TSTs.
- Defining TST engagement authority based on a component commander's operational area or assigned functional mission. The JFC normally defines those situations where immediate destruction of the imminent TST threat outweighs the potential for duplication of effort.
- Identifying specific communication data links between component command and control elements of the joint force to conduct rapid TST attacks.

8.2 Command and Control (C^2) for TST Operations

A critical factor in prosecuting TSTs is the requirement to conduct all the steps of the joint targeting cycle in a short period of time.

8.2.1 Focused Operations

The JFC has several options for structuring command and control (C^2) operations for attacks against TSTs. The overall responsibility for mission execution, coordination, and deconfliction remains with the functional components; the authority to plan and engage should be delegated to the C^2 node with the best information, the best situational awareness, the best weapon system to execute the mission, and direct communications with the operators and/or crew of the weapons system. Having the appropriate level of battlespace awareness at subordinate C^2 nodes will streamline the C^2 cycle and facilitate timely engagement of those targets. The decentralized C^2 nodes can exchange sensor, status, and target information with a fidelity that permits them to operate as a single, integrated entity. Tied together by wide area networks and common interactive displays, they can effectively perform decentralized, coordinated execution of time-sensitive attacks.

8.2.2 Compressed Decision Cycle

Although successful attack of TSTs requires the targeting process to be significantly compressed, the individual steps of the targeting cycle still must be executed. In order for the targeting cycle to be compressed successfully, the joint force and functional component staffs must be thoroughly familiar with the details of each step of the process and with the specific nodes or cells in the joint force and functional component staffs responsible for each portion of the process. Time is saved by conducting detailed prior planning and coordination between joint forces; by a thorough intelligence preparation of the battlespace; by employment of interoperable command, control, communications, computers, and intelligence systems (C^4I); and by clear JFC guidance on what targets constitute a TST. Mission planning and execution activities must take place simultaneously or on a compressed time line.

The six steps of the time-sensitive targeting cycle are detect, locate, identify, decide, strike, and assess (see Fig. 17). During the normal targeting process several steps of the process—target development, weaponeering, and force application—will normally be accomplished ahead of time. The time-sensitive targeting process is compressed in time and in the cycle of actions and decisions inherent in the process. This process becomes even more compressed after the initial attack on the TST, when assessment and restrike decisions must be made soon enough for the reattack to be feasible. The six steps of the TST attack mission cycle interact continuously at the decision stage where target analysis is performed. The attack mission cycle works on three assumptions:

- Commanders provide direction and guidance for the steps of the cycle.
- ISR and target acquisition capabilities are available to support timely target detection and identification.
- The time to complete one entire cycle may vary from target to target and situation to situation.

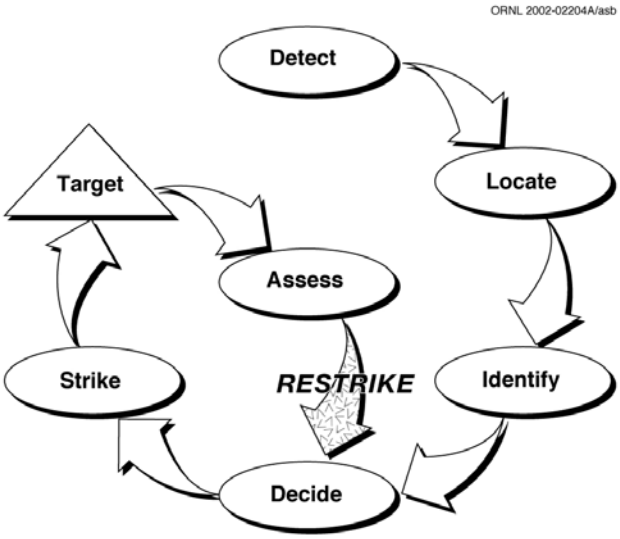


Fig. 17. The time-sensitive targeting process.

8.2.3 TST Information Considerations

Each functional component will possess the ability to view the battlespace with a multitude of ISR and target acquisition assets (organic, joint, and national). Near real-time sharing of this information and intelligence will facilitate planning and, ultimately, execution, among the service components. Sharing this information and intelligence requires a common language as well as systems that can use this common language, correlate individual service component requirements, and communicate them simultaneously to all other component headquarters staffs. These systems, combined with joint force targeting procedures, facilitate the effective and efficient use of all joint force capabilities. The critical links between these systems must include a robust and dedicated service component liaison organization with qualified personnel to accomplish coordination as required.

8.2.4 Considerations for Attack of TSTs

Generally, a wide range of joint force capabilities, both lethal and nonlethal, are suitable for attacking TSTs. These assets may include fixed- and rotary-winged aircraft, the Army Tactical Missile System (ATACMS), the Multiple Launch Rocket System (MLRS), conventional artillery, conventional air-launched cruise missiles, Tomahawk land-attack missiles (TLAMs), naval surface fire support, computer network attack, electronic warfare, and special operations forces (SOF). The JFC's guidance regarding the selection of assets for attacking TSTs may be significantly influenced by factors such as the availability or capability of a weapon system, the engagement characteristics of a weapons system, weather, and rules of engagement. The JFC should have in place procedures that allow maximum flexibility in the attack of TSTs after considering all joint force options. These procedures should allow for rapid handover of the mission tasking from one service component to another if one component cannot attack a TST due to a constraint such as reloading, weather, or range acquisition limitations.

Selection of the best TST attack asset (such as fixed-wing aircraft, ATACMS, or TLAM) begins during the capabilities analysis and tasking phase and continues through the mission planning phase. The individual functional component commanders provide recommendations to the JFC regarding their capabilities to engage TSTs given their weapons systems, capabilities, and current tactical situation. The JFC provides guidance to component commanders to allow them the flexibility to make an effective selection decision for employing the most capable attack asset against a specific TST. Determination of the most capable requires the assessment of six factors:

1. *Deconfliction.* Deconfliction of all aspects of target attack is critical to prevent loss of life or unnecessary expenditure of joint force assets.
2. *Effectiveness.* Depending on the desired effects, the appropriate weapons and/or capabilities must be selected.
3. *Weapon and/or capability responsiveness.* Once TSTs are detected and identified, responsiveness is critical to ensure that the attack opportunities are not lost.
4. *Range.* Selected weapon systems must have the necessary range to attack the TST.
5. *Accuracy.* The weapon system must be able to attack the TST accurately.
6. *Threat.* A TST may be identified and located in heavily defended areas, i.e., in an area of significant air defense or troop or population concentrations. Therefore, the threat of the TST must be weighed against the risk of collateral damage in a populated area or putting aircraft at risk in air defense zones.

9. BDA Support to Operational Planning and Execution: Lessons Learned from Combat Operations

Battle damage assessment provides the commander information on the status of the enemy, vital information in formulating subsequent battle plans, and valuable empirical data on weapon and weapon system performance. Maneuver force BDA facilitates both the "bean counting" of order of battle management, as well as the computation of the combat effectiveness of the units engaged.

Operation Desert Storm provides an example of how BDA can support operational planning and execution. Initial staff estimates maintained that the preconditions for a successful ground offensive required that there be a favorable combat ratio between fielded forces and that Iraqi forces be sufficiently cut off from reinforcements; from strategic command, control, communications, and intelligence (C^3I); and from combat support. The required levels of damage to strategic systems and attrition of forces in the field were determined on the basis of these objectives.

As the war progressed, nearly every operational-level decision required an understanding of the current status of enemy forces as compared to expectations held during the planning process. BDA provided this information by supporting key decisions such as those illustrated in Fig. 18.

Critical to these decisions was the knowledge of what damage the enemy had actually incurred (BDA). BDA began with the physical and functional damage assessments of each target struck. These Phase I and II BDA reports were compiled and collated with system-level indicators to provide the basis for target systems assessments (Phase III BDA reports) for each target system attacked. Target systems assessments were the best estimates of the operational and strategic effects of coalition strikes supporting operational-level decision making throughout the joint force.

U.S. forces have participated in three operations in which BDA was a critical tool: Desert Storm (January–February 1991), Desert Fox (December 1998), and Allied Force (March–June 1999). The following sections examine the role of BDA in each of these operations.

Decision	BDA Support
"Can the ground offensive begin?"	"Has attrition in the Iraqi-fielded ground forces reached 50%?"
Apportionment decision (targeting)	Target systems status
"Can I operate in the battlespace at acceptable risk of weapons of mass destruction (WMD) attack?"	"Were attacks on mobile Scud launchers and WMD facilities successful?

Fig. 18. How BDA supports key operations decisions.

9.1 Operation Desert Storm

Desert Storm was the first large-scale U.S. combat operation after Vietnam. The characteristics of this operation were as follows:

- The offensive was preceded by a six-month buildup, including tailored training before the beginning of combat operations.
- Desert Storm included a major coalition of several countries, most of which contributed air forces.
- The operation covered a large geographical area.
- Saudi Arabia was a sanctuary for coalition bases, with the only militarily significant threat being tactical ballistic missiles.
- Until the four days of ground operations began, combat operations were carried out almost exclusively by aircraft and cruise missiles.
- The effort saw a high operations tempo over the entire period of combat.
- New targets continued to be developed throughout the conflict.

According to DOD's F*inal Report to Congress on the Persian Gulf War,* the Desert Storm BDA process was considered only a limited success. In fact, BDA was identified as one of the four major intelligence shortcomings. DOD cited the following BDA problems from Desert Storm:

- The BDA process was "difficult," especially for supporting restrike decisions.
- BDA was "slow and inadequate." Once combat operations began, the tempo of air operations quickly outpaced the BDA process.
- Intelligence production and collection capabilities were called on to produce results that had not been asked for in the past, especially in the area of mobile targets.
- There was no DOD-wide formalized training in the BDA process. This included inadequate doctrine, methodology, and procedures.
- There was insufficient and inappropriate manpower for BDA.
- The Army had no BDA-focused automated data processing software.

The *Joint Battle Damage Assessment Joint Feasibility Study* identified additional problem areas in the BDA process during Desert Storm:

- *Dissemination of imagery and other information from both inside and outside the theater.* Problems in this area included lack of service equipment compatibility, deficient C^4I capabilities, and bandwidth limitations.

- *Processing of imagery and other BDA-required information.* The data processing problems often involved procedures, not equipment. These problems resulted in inadequate support of the JFC dynamic decision process necessary to sustain target development, maneuver and mission planning, and BDA. For example, a key processing problem identified during Desert Storm was that imagery from manned aircraft was sent from the aircraft's base to Riyadh for processing and exploitation instead of being analyzed at that airbase.

- *Coordination in the theater.* This problem was a further manifestation of the coordination problem plaguing the entire joint targeting process. It involved role and mission jealousies between the service components, lack of situational awareness, lack of

equipment combined with interoperability problems, deconfliction and synchronization problems, and (perhaps underlying most of the other elements) lack of, or inadequate, doctrine, tactics, techniques and procedures.

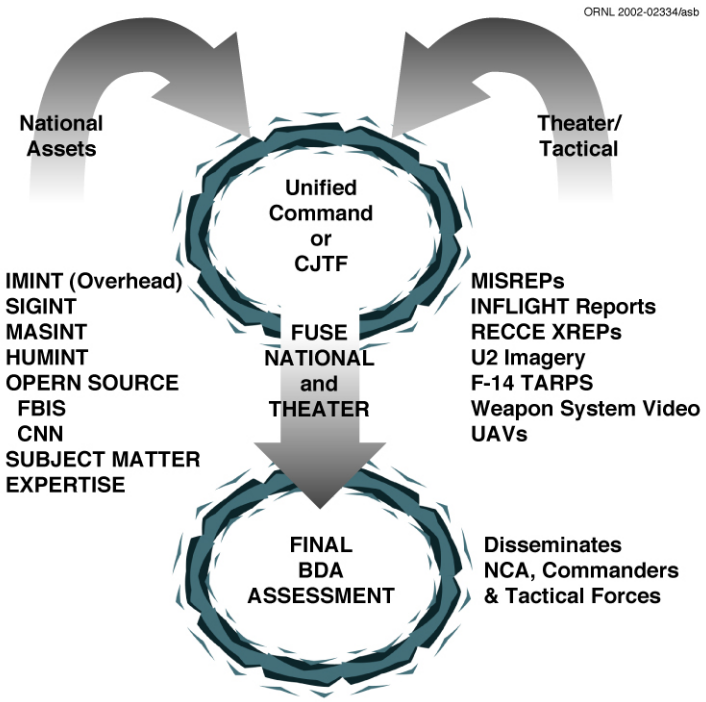
- *Training of intelligence personnel, imagery analysts and operations personnel.* Shortfalls in this area particularly affected collection management and interpretation of imagery. Although regulations and operations plans detailed organizational structures to handle tasking of collection assets, the system often did not work because of inadequate numbers of trained, qualified personnel. Imagery analysts and other intelligence personnel were not trained to use all available assets or to effectively analyze and interpret imagery from all the available sources. The importance of fusing signal and human intelligence to aid in the interpretation of imagery intelligence is not often taught or practiced. Analysts often lacked the knowledge of structural vulnerabilities and weapons effects to accurately interpret imagery, a problem that is very pronounced when penetrating bombs are employed on hardened structures. Analysts were not trained in effective use of aircraft head-up display and sensor imagery and other instrumentation in BDA, nor were they trained to counter camouflage, concealment, and deception operations by the Iraqis.

Essentially, Desert Storm outstripped intelligence collection, production, and analysis capabilities with a resulting negative effect on BDA timeliness and effectiveness. This was exacerbated by a lack of trained analysts and a lack of doctrine, tactics, techniques and procedures.

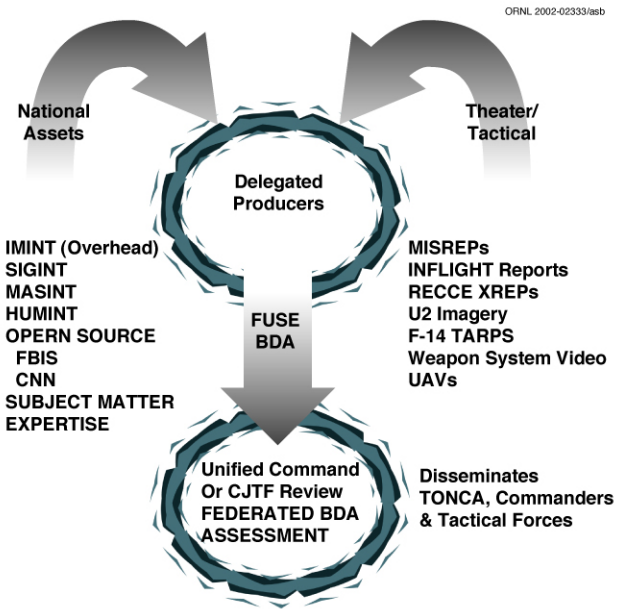
Desert Storm demonstrated that large, complex operations will quickly outpace any single command's ability to keep up with the BDA requirements. As a partial remedy to the problem, supporting commands began working directly through the supported command to facilitate the information and intelligence flow. This has led to the federated BDA concept. Figure 19 depicts the traditional, non-federated structure of information and intelligence flow and the federated BDA structure.

The federated BDA guidelines are as follows:

- All unified commands are eligible to be tasked to participate in the BDA process.
- The supported Commander in Chief (CINC) /JFC is the final authority for all BDA in a particular operation.
- The joint intelligence staff-targeting (J2-T) will facilitate any command in setting up federated partners, responsibilities, concept of operations, and architecture requirements, and will ensure that requirements are addressed in Chairman, Joint Chiefs of Staff (CJCS) orders.
- J2-T, through the National Military Joint Intelligence Center (NMJIC) crisis/target BDA center, will assist in the coordination and dissemination of BDA-related information and intelligence between federated partners and the supported CINC/JFC.
- Supported CINCs/JFCs will task BDA-related responsibilities for federated partners along delegated lines of communication having responsibility for intelligence production.
- A federated BDA annex should be developed by the supported CINC/JFC and fully coordinated with all federated partners.
- Federated BDA architectures should be tested prior to execution.



TRADITIONAL BDA STRUCTURE



FEDERATED BDA STRUCTURE

Fig. 19. The traditional, nonfederated structure of information and intelligence flow (*top*) and the federated BDA structure (*bottom*).

9.2 Operation Desert Fox

The BDA improvements following Desert Storm have been incorporated, at least in part, in subsequent combat operations. The next combat operation that included enough targets to effectively exercise the BDA process was Desert Fox, a four-day operation in December 1998 against Iraq. The characteristics of the Desert Fox operation were the following:

- Combat operations were planned in detail and executed in almost script-like fashion.
- The only other coalition partner was Great Britain.
- While targets were struck throughout Iraq by cruise missiles, manned aircraft stayed in the southern portion of Iraq so that manned aircraft did not enter the surface-to-surface anti-aircraft missile engagement zones.
- There was no theater ballistic missile (TBM) threat.
- Over a four-day period, 600 sorties were flown (the equivalent of about one day's sorties during Desert Storm).
- The target list was fixed and limited; target development during execution was limited to suppression of enemy air defenses.

A comparison of Desert Storm and Desert Fox clearly indicates that Desert Fox was not a good test of whether or not the BDA problems of Desert Storm had been resolved. In fact, some of the major Desert Storm problems were irrelevant to the Desert Fox experience. Desert Fox was too short, the target set was fixed, and there was limited target development during execution.

Nevertheless, it was found that the BDA process was still slow in providing feedback to the CINC. The Phase I BDA from the first day's strikes had not been formulated by the end of combat operations on day 4. On the other hand, the use of the new federated BDA structure in Desert Fox appears to have limited or at least mitigated some of the internal intelligence, intelligence-operations, and theater/non-theater squabbles of Desert Storm.

9.3 Operation Allied Force

Allied Force was the second significant operation subsequent to Desert Storm. Allied Force was a NATO air operation against the Federal Republic of Yugoslavia, occurring between March 24 and June 20, 1999. A total of 37,225 sorties were flown during Allied Force, with over 23,000 bombs and missiles expended. Of significance is that 30% of the weapons employed were precision guided munitions. The characteristics of Allied Force are summarized in the following:

- No extended training focused on Yugoslavia before operations began.
- The operation was carried out under a major coalition of several NATO countries.
- The operation covered a very small geographical area.
- Combat operations were exclusively aircraft and cruise missile strikes.
- Weather dictated the tempo of operations.
- There were a moderate number of target sets, with target development throughout the conflict.

According to the 14 October 1999, Office of the Assistant Secretary of Defense Public Affairs (OASD/PA) *Joint Statement on the Kosovo after Action Review,* federated BDA was used during Allied Force. The target sets were federated between the U.S. European Command (USEUCOM) and NMJIC. The USEUCOM-established JTF, under Admiral Ellis, was designated as the BDA authority. NMJIC added the U.S. Strategic Command (USSTRATCOM) as an additional

supporting command when the targets and target sets increased after the NATO Summit on April 23, 1999. As in Desert Fox, federated BDA mitigated some of the coordination problems and appeared to increase BDA responsiveness.

The multiple communications paths that were used to send operations and intelligence data complicated the BDA process. While redundant communication paths are helpful in ensuring receipt of data, the need to pass data via multiple unconnected systems increases time and introduces the possibility of either wrong data or the wrong classification of data being transferred from one system to the other. In many instances, the transfer of data from one system to the another required the employment of the "sneaker net"—i.e., physically copying data onto a disk and then loading that data onto the other system. The classification of data further complicates the process. U.S.-only systems work on SIPRNET, and this network cannot be connected to any other coalition network. As a further complication, each coalition partner has differing levels of access to U.S.-produced classified data.

INTELINK was used more during this operation than ever before to post BDA-related data. Operations data was placed on a number of classified web sites, along with nearly all U.S. weapon systems video. Thousands of pre- and post-strike images were also on a number of these classified sites, as well as virtually all of the Phase I, II, and III BDA reports.

The number of destroyed tanks, armored personnel carriers, and artillery pieces were not reported in the Phase II BDA reports, nor were the combat effectiveness assessments of the Yugoslavian units in Kosovo. Since there was no Phase II report on mobile targets attacked, these data obviously also were not included in the Phase III report.

As in Operation Desert Fox, overall the BDA for Allied Force appeared to be of better quality and more responsive than the BDA in Operation Desert Storm. Allied Force and Desert Storm shared some characteristics, including some preconflict buildup and training, use of coalition forces, availability of sanctuaries, heavy use of aircraft and cruise missiles, and target development throughout the operation. Major differences in the two operations included scale (the number of strike aircraft, sorties, and bases), the size of the geographical area, and weather impacts on operations.

There were also vast differences in the BDA focus for Desert Storm and Allied Force. In Desert Storm the emphasis was on the targets illustrated in Fig. 15, while the same type of targets were fourth on the Allied Force target list. The *Joint Statement on the Kosovo after Action Review* noted that collection priorities had an impact on the Allied Force BDA process because BDA was the fourth priority in this action, behind force protection, target development, and situational awareness. Considering the number of collection assets and the impact of weather, fourth priority meant that many BDA collection requirements were not met in a timely manner. Lastly, the tempo of operations was continuous in Desert Storm and intermittent in Allied Force. Thus, like Operation Desert Fox, the Allied Force operation did not answer the question of whether or not Desert Storm BDA problems were resolved.

10. BDA Process Improvements

Despite differences in the operations, Desert Fox and Allied Force have demonstrated that there have been improvements in the BDA process since Desert Storm. However, Desert Fox and Allied Force also demonstrate that there are still many improvements to be made to make the joint targeting process more useful and responsive to the CINC's or the JFC's mission requirements, goals, and objectives.

One of the most glaring weaknesses is the ad hoc nature of the BDA process. BDA cells are not staffed in peacetime but are filled as needed during combat operations. This approach to staffing means that little BDA training occurs during peacetime, with obvious consequences during combat operations. BDA cells are "stood up" in crisis, borrow personnel from other staff sections, have no dedicated equipment, are not familiar with the equipment required in the joint BDA process, and are not familiar with the tactics, techniques, and procedures required for an effective BDA process.

The BDA process needs improvement in the following areas:

- Common, interoperable C^4I architecture and BDA-specific software applications
- Staffing of intelligence analysts and personnel in BDA cells and appropriate training in
  - collection management
  - analytic and interpretive skills
  - damage interpretation
  - collation and validation of BDA reports
  - multi-intelligence discipline fusion
- Timely processing and interpretation of imagery, including
  - modeling to assist in imagery analysis
  - decision aids for imagery analysis
- Data management and synthesis, including the development of modeling to assist in Phase II and III BDA analysis
- Standard joint doctrine and tactics, techniques, and procedures, to include
  - improvement in BDA / order of battle / collections interaction
  - development of common order of battle database
  - improvement in damage report validation and deconfliction
- Combat assessment process that meets the commander's decision cycle, including
  - increasing accuracy and timeliness of Phase II and III reporting
  - development of a combat effectiveness model
  - development of decision aids to speed the process
- Streamlined processes for time-critical targets
- Accurate and timely processing of mobile-target BDA
- Dissemination of reports to the tactical level commanders
- Integration of combat assessment into operational situational awareness

11. The Army Objective Force and the Future Combat System of Systems (FCS)

11.1 The Army Objective Force

The Army Objective Force will be part of a joint team that is decisive in any type of operation against any level of threat, in any environment. This joint team requires a force projection Army that is strategically and operationally responsive, rapidly deployable, eminently reliable, available and sustainable, able to change patterns of operations faster than the enemy can respond, and able to adjust to enemy changes of operations faster than he can exploit them—in other words, it must be a versatile and agile force capable of dominating any situation or adversary.

U.S. forces will deploy and fight as a joint and combined force. Once in the area of operations, future combat forces must be versatile enough to meet varied mission demands across the spectrum without extensive reorganization and augmentation and be agile enough to move from one type of operation to another without loss of operational momentum. Information has a critical enabling role for this force. Supported by joint C^4ISR systems, information ensures the planning and execution of the knowledge-based fight. This information will enable the commander to shape the battlefield with standoff and precision fires and maneuver to set conditions at the time and place of his choosing. Future forces must be capable of maximizing the effectiveness of standoff while maneuvering on an asymmetric battlefield. To execute decisive operations this force must close with and destroy enemy forces through assured overmatch, tactical standoff, and close combat assault.

11.2 Future Combat Systems

Future Combat Systems (FCS) is a networked manned and unmanned system of systems that will serve as the core building block within all unit of action (UA) echelons to develop the overmatching combat power, sustainability, agility, and versatility necessary for full-spectrum operations. FCS will provide the UA assured overmatch for conducting standoff attack and close combat assault against all threats, in all dimensions. FCS is not a battalion: it is a networked system of systems manned by soldiers and fighting teams of teams. It will significantly enhance the overall effectiveness of units of action in ways that cannot be achieved today.

FCS will consist of a family of advanced, networked space-, air-, and ground-based maneuver, maneuver support, and sustainment systems that will include manned and unmanned platforms. It also will include suites of information technologies; reconnaissance, surveillance,

> "Objective Force operations will be characterized by developing situations out of contact; maneuvering to positions of advantage; engaging enemy forces beyond the range of their weapons; destroying them with precision fires and, when necessary, by tactical assault at time and places of our choosing."
>
> —*Chief of Staff White Paper: Concept for the Objective Force,* "Concept Summary"
>
> "The Objective Force attains organic, higher-level Army, joint and coalition effects to set conditions to enter battle on our terms, seize the initiative before contact and employ our strengths against enemy weaknesses . . . Units of action then rapidly transition to the next engagement or operations across the full spectrum of conflict."
>
> —*Objective Force,* TRADOC Pamphlet 525-3-91 (draft), 6 Nov. 2001

and target acquisition (RSTA) networks, and battle command systems that will enable the tactical unit to operate at a level of synchronization heretofore unachievable.

The largest FCS systems will be lighter than current armored and mechanized systems, with each element possessing common or multifunctional characteristics. Many FCS platforms will be multifunctional and modular, combining two or more tactical functions, such as assault and indirect fires, air defense, forms of RSTA, network communications, battle command, and mobility support. Other platforms, such as small, unmanned aerial and ground vehicles, may be single-function.

FCS will allow units of action to

- *See First* — Units of action must see the parts—detecting, identifying, and tracking enemy, neutral/noncombatant, and friendly forces—while maintaining situational awareness of the operational environment, enabled by a sophisticated network of Army and Joint sensors.
- *Understand First* — Units of action must leverage the ability to see and discern a common operating picture (COP) that allows commanders at all levels to identify enemy centers of gravity, conceptualize solutions, and create and assess courses of action through accelerated collaborative planning.
- *Act First* – Units of action will be able act first by achieving freedom of action to engage at tactical standoff, move, and re-engage while denying the enemy the same freedom to act or respond effectively.
- *Finish Decisively* — Units of action will destroy the enemy in detail through close combat assault. Destroying the enemy's ability to synchronize its fight and freedom of action, U.S. forces will engage the enemy at the time and place of their choosing with synchronized combined arms, rapidly transitioning to the next engagement.

Before contact, units of action must develop the situation, decide when and where to fight, set conditions to ensure tactical success, and maneuver to a position to initiate enemy contact at an advantage. The actions that must occur before contact with the enemy are (1) combined efforts by all echelons to degrade threat C^4ISR; (2) leveraging of higher headquarters intelligence preparation of the battlefield; (3) shaping the battlefield with maneuver, fires, or obstacles in depth; (4) fusing RSTA information into a common operational picture tailored to the unit's task and purpose; (5) employing manned and unmanned air, ground, and space reconnaissance and surveillance; (6) neutralizing long-range non-line-of-sight fires; and (7) tactically tailoring or retasking for each mission.

What will change with the use of FCS is networked RSTA—manned and unmanned air and ground RSTA and remote sensors—available to all unit of action echelons and linked to all shooters.

Units of action seek standoff in sensing and in line-of-sight (LOS), beyond line-of-sight (BLOS), and non-line-of-sight (NLOS) fires. Seeing and understanding BDA is critical during the engagement, as leaders must quickly transition to subsequent actions and the assault while maintaining relentless pressure. Additionally, effective BDA ensures efficient expenditure of limited munitions, thereby reducing requirements for increased levels of supply and associated transport.

11.3 Capabilities of FCS

FCS must enable units to deploy rapidly without the need for system-specific training prior to deployment and without placing an unacceptable burden on the soldier or the individual platform. To enable responsiveness, all aspects of the system of systems must be easy to learn and user-friendly, must preclude catastrophic mistakes, and must facilitate operational competence. FCS support must provide common training and training support activities, to include joint capabilities, in live, constructive, and virtual environments for use at service schools, home station, combat training centers, and theaters of deployment. Embedded training must allow individual and collective training in a joint environment on a digital terrain that is representative of the actual mission terrain.

FCS will be standardized and interoperable with existing and planned C^4ISR systems used by the other military services and by U.S. allies to the greatest extent possible. Standardizing will be accomplished by conforming to the DOD Technical Architecture Framework for Information Management, Joint Technical Architecture, and the Army Technical Architecture.

In order to increase agility and versatility, FCS will provide the following capabilities:

- Enable battle command on the move supported by C^4ISR architecture for continuous and updated estimates of the situation; permit en route mission planning and rehearsal in both stand-alone and networked modes.
- Provide dominant situational understanding. The FCS tailorable, networked battle command system will provide dismounted and mounted forces, leaders and soldiers, with mutually supporting situational awareness, horizontally and vertically integrated from the strategic to the tactical level.
- Allow sharing of the integrated COP to enable an understanding of threat.
- Provide collaborative decision aids by
  - maintaining situational understanding at all times,
  - identifying enemy vulnerabilities,
  - providing information for reasoned decisions, and
  - synchronizing maneuvers, fires, and RSTA.
- Enable decisive maneuvers, horizontal and vertical, day and night, in all terrain and weather conditions, synchronized with Army and joint force fires and RSTA.
- Provide a dynamic, extended-range, redundant communications network that is highly integrated, ubiquitous, and capable of greatly increased, yet scalable data rates.
- Provide interoperability with Army legacy and interim systems, as well as joint force and interagency systems.
- Provide common, general-purpose networks that all classified or unclassified customers can use and that are interoperable with joint force networks.
- Continuously fuse, monitor and disseminate information from a variety of sources to support commanders' critical information requirements, combat action, decision-making, and analysis. FCS networks will enable efficient information management to move vital information, tailored to unit task and purpose, through the network in a timely manner.
- Integrate and update enemy combat information, from a variety of human and automated sources, in near-real time, to provide the means for situational understanding; and establish, maintain, and distribute a synthesized COP tailored to a unit's task, purpose, and situation.

FCS will vastly improve intelligence, surveillance, reconnaissance, and target acquisition by

- employing improved sensors by combining the resources of joint force and Army manned and unmanned ground, air, and space sensors through passive and aggressive RSTA networked into an integrated COP for unprecedented and timely situational awareness and understanding;
- performing automated pattern analysis to detect, locate, and identify enemy combatants and systems;
- enabling situational understanding by standoff and loitering systems to
  - gain information about enemy forces that are dispersed, covered and concealed, masked, and fleeting, and
  - sort through decoys, deception, and disinformation;
- sorting from a variety of enemy data entries what is most dangerous and provides the highest payoff for engagement at tactical standoff, to set up favorable conditions for tactical maneuvers;
- providing highly precise, targetable data to shooters; and
- enabling reliable, timely BDA.

One of the key tenants of FCS is lethality. The Army states that "enhanced lethality will allow Army forces to destroy any opponent quickly, with shattering effect. Lethal Army forces can combine the elements of combat power to provide overwhelming and decisive force at the right time, at the right place, and for the right purpose" (FM 1-0). FCS lethality will

- provide the capability to destroy enemy formations at longer ranges, with smaller-caliber weapons, greater precision, and more devastating effect without frequent positioning through technical improvements in weaponry and munitions;
- enable the command and control needed to synchronize fire, maneuver, and achieve RSTA in real time to close with and destroy the enemy;
- employ advanced, highly mobile Army and joint force fire delivery systems;
- proactively engage LOS/BLOS/NLOS threat targets based on target detection and identification information provided in the COP;
- provide sensor-to-shooter linkage that will enable a decision to engage in seconds using automated, semi-automated, or manual fire control, distribution, and clearance procedures;
- provide automated target identification to reduce latency in providing effects; and
- allow Army forces to destroy any opponent quickly through key enablers that include organic LOS/BLOS/NLOS fires from the Army and joint forces.

12. BDA Improvements under FCS

Battle damage assessment (BDA) is important to achieving the goals and objectives of FCS. BDA, discussed at length in Section 5, above, can be summarized as involving

> the timely and accurate estimate of damage resulting from the application of military force, either lethal or nonlethal, against a predetermined objective. Battle damage assessment can be applied to the employment of all types of weapons systems (air, ground, naval, special forces weapon systems) throughout the range of military operations. Battle damage assessment is primarily an intelligence responsibility with required inputs and coordination from the operators. Battle damage assessment is composed of physical damage assessment, functional damage assessment, and target system assessment. (JP 1-02)

In order for FCS to develop out-of-contact situations that enable the commander to shape the battlefield and set conditions at the time and place of his choosing, as well as maximize the effectiveness of standoff, timely and accurate BDA is essential. The very essence of the FCS concepts of "See First, Understand First, Act First, and Finish Decisively" are not achievable without real-time BDA. Every action that is required to support these tenets is a part of the joint targeting process and thus an integral part of BDA.

In order to achieve real time assessment of weapons effects to achieve the goals and objectives of FCS, the BDA process must occur in near-real time. The time-sensitive targeting process described in Sect. 8 and illustrated in Fig. 14 is a good model for addressing the requirements of FCS, in that if we make this process respond in near-real time, then those changes can be applied to the targeting process as a whole.

Using the time-sensitive targeting process as a template and applying technology, systems solutions, and training and simulation, we can achieve the objectives set forth in FCS. It is also prudent to keep in mind the BDA process improvements that were identified in Sect. 10 as they relate to the means to improve BDA to assist in making FCS decisive in any type of operation against any level of threat in any environment. Figure 20 depicts the BDA process improvements matched with the steps of the time-sensitive targeting process. A programmatic focus on addressing these process improvements will improve the ability of FCS to attack targets beyond line of sight and provide near-real time attack assessment in order to create the conditions for success on the battlefield.

FCS can achieve its goal of decisive operations with the combination of precision engagement and a vastly improved BDA process. This combination would enable FCS to employ a joint fires–based capability that would truly represent and overmatch for any adversary across the spectrum of conflict.

Precision engagement must consist of a system of systems that enables joint forces to locate and track the target, provide responsive command and control, create the desired effect on the target or target system, assess the level of success of the target attack in near-real time, and have an inherent capability to reattack to achieve the desired effects on the target or target system.

Precision engagement is empowered by information dominance. This means creating a disparity between what U.S. forces know and what the enemy knows about the battlespace and operations

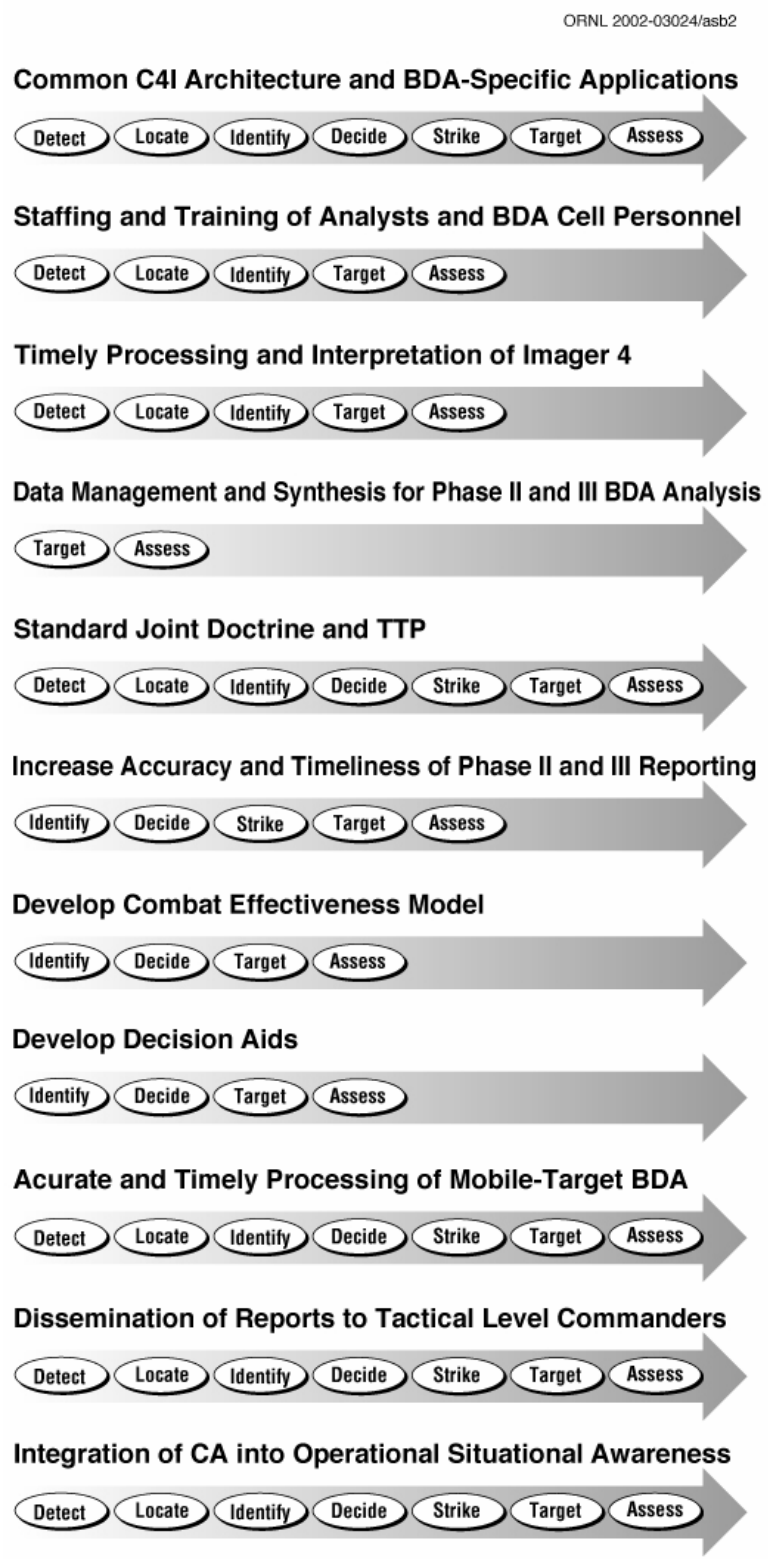


Fig. 20. BDA process improvements matched with the steps of the time-sensitive targeting process (Fig. 14).

within it. To achieve information dominance, FCS must have improved organic sensors; have access to information from the sensors of other military services as well as joint force and national-level sensors; have sensor-to-shooter linkage; operate in a joint C^4ISR architecture; process information into intelligence at machine speed; and distribute intelligence, targeting information, and combat assessment information to the correct nodes to meet operational timelines. The goal for combat assessment should be to provide Phase 1 and 2 BDA within an air tasking order (ATO) cycle (24 hours) and Phase 3 assessment within the following ATO cycle (36 hours).

Achieving precision engagement, information dominance, and real-time combat assessment will enable FCS and the joint forces to shape the battlespace. The goal of shaping the battlespace is simply to set the conditions for success by eliminating the enemy's capability to fight in a coherent manner before committing U.S. forces to decisive operations.

The only way to meet the combat assessment timelines is to automate the entire joint targeting process and develop software that performs analysis, data management, and data distribution in near-real time. Currently, only portions of the joint targeting process are automated, and there is no mandate for Service-developed systems to be interoperative. FCS will not meet its objective for dominance unless this joint interoperability problem is addressed. The joint C^4ISR must be the backbone upon which precision fires, information dominance, and timely BDA is built.

The JFC will create the conditions for decisive operations by FCS forces by using information dominance to conduct joint fires–based precision engagement. The JFC will shape the strategic and operational battlespace with joint fires to create the conditions for FCS to be decisive in the tactical engagements with the adversary. Underpinning these operations will be the joint targeting process and particularly combat assessment.

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Glossary

This glossary defines the terms and joint organizations found in this report, to ensure a mutual understanding of their use within the report.

Air interdiction. Air operations conducted to destroy, neutralize, or delay the enemy's military potential before it can be brought to bear effectively against friendly forces at such a distance from friendly forces that detailed integration (coordination) of each air mission with the fire and movement of friendly forces is not required. (JP 1-02)

Air operations center (AOC). The principal air operations installation from which aircraft and air warning functions of combat air operations are directed, controlled, and executed. The AOC is the senior agency of the air force component commander, from which command and control of air operations are coordinated with other components and services. (JP 1-02)

Air tasking order (ATO). A method used to task and disseminate to components, subordinate units, and C2 agencies the projected sorties, capabilities, and/or forces to targets and specific missions. (JP 1-02)

Allocation. The translation of the apportionment decision into total numbers of sorties by aircraft type available for each operation or task. (FM6-20-10)

Apportionment. The determination and assignment of the total expected effort by percentage and/or priority that should be developed by the various air operations and/or geographic areas for a given period of time. (FM 6-20-10)

Battle damage assessment (BDA). A joint program to determine if the required target effects are being achieved for each of the components. (FM 6-20-10) The timely and accurate estimate of damage resulting from the application of military force, either lethal or nonlethal, against a predetermined objective. BDA is composed of physical damage assessment, functional damage assessment, and target system assessment. (JP 1-02)

Battlefield coordination element (BCE). An Army liaison provided by the Army component or force commander to the air operations center (AOC) and/or to the component designated by the joint force commander to plan, coordinate, and deconflict air operations. The battlefield coordination detachment processes Army requests for air support, monitors and interprets the land battle situation for the AOC, and provides the necessary interface for exchange of current intelligence and operational data. (JP 1-02)

Brigade (BDE). A unit usually smaller than a division to which are attached groups and/or battalions and smaller units tailored to meet anticipated requirements. (JP 1-02)

Campaign plan. A plan for a series of related military operations aimed at accomplishing a strategic or operational objective within a given time and space. (JP 1-02)

Close air support (CAS). Air action by fixed and rotary wing aircraft against hostile targets that are in close proximity to friendly forces and that requires detailed integration (coordination) of each air mission with the fire and movement of those forces. (JP 1-02)

Combat assessment (CA). The determination of the overall effectiveness of the force employment during military operations. CA is composed of three major components: battle damage assessment, munitions effectiveness assessment; and reattack recommendation. (JP 1-02)

Damage assessment. The determination of the effect of attacks on targets. (JP 1-02)

Functional damage assessment. The estimate of the effect of military force to degrade or destroy the functional or operational capability of the target to perform its intended mission and of the level of success in achieving operational objectives established against the target. (JP 1-02)

High-payoff target (HPT). A target whose loss to the enemy will significantly contribute to the success of the friendly course of action. HPTs are those high-value targets that must be acquired and successfully attacked for the success of the friendly commander's mission. Also called high-value targets (HVTs). (JP 1-02)

Human intelligence (HUMINT). A category of intelligence derived from information collected and provided by human sources. (JP 1-02)

Immediate target. A target that has been identified too late, or not selected for action in time, to be included in the normal targeting process and therefore that has not been scheduled for attack. (JP 1-02)

Information operations (IO). Actions taken to affect adversary information and information systems while defending one's own information and information systems. (JP 1-02)

Interdiction. An action to divert, disrupt, delay, or destroy the enemy's surface military potential before it can be used effectively against friendly forces. (JP 1-02)

J2, Intelligence. A joint force, J2, that provides intelligence to all levels of command for planning, directing, and conducting operations. J2 is involved in target prioritization, detection, and validation and has primary responsibility for combat assessment for all service component operations. (FM 6-20-10)

Joint air operations. Air operations performed with air capabilities and/or forces made available by components in support of the JFC's operation or campaign objectives, or in support of other service components of the joint force. (JP 1-02)

Joint air operations plan. A plan for a connected series of joint air operations to achieve the JFC's objectives within a given time and theater of operations. (JP 1-02)

Joint force. A general term applied to a force composed of significant elements, assigned or attached, of two or more military departments operating under a single JFC. (JP 1-02)

Joint force air component commander (JFACC). The JFC normally designates a JFACC when two or more services employ air assets within the same area of operations. The primary purpose of a JFACC is to provide unity in employing air power for the benefit of the joint force as a whole in support of JFC's objectives. (FM 6-20-10)

Joint force commander (JFC). A general term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control of a joint force. (JP 1-02)

Joint force land component commander (JFLCC). A JFC may designate a JFLCC when major elements of more than one service or nation are participating in an operation. The JFLCC is responsible for planning and executing land operations as directed by the JFC. (FM 6-20-10)

Joint force maritime component commander (JFMCC). The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for making recommendations on the proper employment of assigned, attached, and/or made available for tasking maritime forces and assets; planning and coordinating maritime operations; or accomplishing such operational missions as may be assigned. The JFMCC is given the authority necessary to accomplish missions and tasks assigned by the establishing commander. (JP 1-02)

Joint force special operations component commander (JFSOCC). The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for making recommendations on the proper employment of assigned, attached, and/or made available for tasking special operations forces and assets; planning and coordinating special operations; or accomplishing such operational missions as may be assigned. The JFSOCC is given the authority necessary to accomplish missions and tasks assigned by the establishing commander. (JP 1-02)

Joint integrated prioritized target list (JIPTL). A prioritized list of targets and associated data approved by the JFC. (JP 1-02)

Joint target list (JTL). A consolidated list of selected targets considered to have military significance in the JFC's area of responsibility. (JP 1-02)

Joint task force (JTF). A joint force that is constituted and so designated by the Secretary of Defense, a combatant commander, or an existing joint task force commander. (JP 1-02)

Joint Warfare Analysis Center (JWAC). The Joint Warfare Analysis Center, an element of the U.S. Joint Forces Command, provides analysis of engineering, scientific, and intelligence data and the integration of these disciplines with combatant commander requirements for target system analysis. JWAC has specific expertise in the analysis of civilian infrastructure including electric power; telecommunications, petroleum, oils, and lubricants; lines of communications; commodities; critical industries; military logistics; and strategic assessments and impacts. JWAC can be a valuable resource during target development, target system assessment, BDA, unique weaponeering cases, and collateral damage analysis. (JP 2-01.1)

Measure of effectiveness. Tools used to measure results achieved in the overall mission and execution of assigned tasks. Measures of effectiveness are a prerequisite to the performance of combat assessment. (JP 1-02)

Munitions effectiveness assessment. Conducted concurrently and interactively with battle damage assessment, the assessment of the military force applied in terms of the weapon system and munitions effectiveness to determine and recommend any required changes to the methodology, tactics, weapon systems, munitions, fusing, and/or weapon delivery parameters to increase force effectiveness. (JP 1-02)

On-call targets. Planned targets that are known to exist in an operational area and are located in sufficient time for deliberate planning to meet emerging situations specific to campaign objectives. (JP 1-02)

Physical damage assessment. The estimate of the quantitative extent of physical damage (through munitions blast, fragmentation, and/or fire damage effects) to a target resulting from the application of military force. This assessment is based upon observed or interpreted damage. (JP 1-02)

Planned targets. Targets that are known to exist in an operational area, and against which effects are scheduled in advance or are on-call. Planned targets have two subcategories: scheduled or on-call. (JP 1-02)

Reattack recommendation. An assessment, derived from the results of battle damage assessment and munitions effectiveness assessment, providing the commander systemic advice on reattack of targets and further target selection to achieve objectives. (JP 1-02)

Reconnaissance (RECCE). A mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. Also called RECON. (JP 1-02)

Scud. The NATO reporting name (not an acronym) for a Russian army short-range liquid-propellant surface-to-surface ballistic missile, the SS-1. The Makeyev OKB Design Bureau developed the Scud from the German V2 in the 1950s. The -D variant developed in the 1980s can deliver a conventional high-explosive warhead, a fuel-air warhead, or a hundred 5-kg anti-personnel bomblets. The name "Scud" is also used to refer to an Iraqi modification of the same missile. Like some other missiles, this weapon is easily transported and can be launched from a truck. The Iraqis developed four versions: the Scud, the longer-range Scud, the Al Hussein, and the Al Abbas.

Secret Internet Protocol Router Network (SIPRNET). Worldwide secret level packet switch network that uses high-speed internet protocol routers and high-capacity Defense Information Systems Network circuitry. (JP 1-02)

Squadron (SQ). 1. An organization consisting of two or more divisions of ships, or two or more divisions (Navy) or flights of aircraft. It is normally but not necessarily composed of ships or aircraft of the same type. 2. The basic administrative aviation unit of the Army, Navy, Marine Corps, and Air Force. 3. Battalion-sized ground or aviation units in U.S. Army cavalry regiments. (JP 1-02)

Target. An area, complex, installation, force, equipment, capability, function, or behavior identified for possible action to support the commander's objectives, guidance, and intent. Targets fall into two categories: planned and immediate. (JP 1-02)

Target acquisition. The detection, identification, and location of a target in sufficient detail to permit the effective employment of weapons. (JP 1-02)

Target analysis. An examination of potential targets to determine military importance, priority of attack, and weapons required to obtain a desired level of damage or casualties. (JP 1-02)

Targeting. The process of selecting and prioritizing targets and matching the appropriate response to them, taking account of operational requirements and capabilities. (JP 1-02)

Target of opportunity. A target visible to a surface or air sensor or observer that is within range of available weapons and against which fire has not been scheduled or requested. (JP 1-02)

Time-sensitive targets (TST). Those targets requiring immediate response because they pose (or will soon pose) a danger to friendly forces or are highly lucrative, fleeting targets of opportunity. (JP 1-02)

Unplanned immediate targets. Those immediate targets that are known to exist in an operational area but are not detected, located, or selected for action in sufficient time to be included in the normal targeting process. (JP 1-02)

Wing (WE). 1. An Air Force unit composed normally of one primary mission group and the necessary supporting organizations—i.e., organizations designed to render supply, maintenance, hospitalization, and other services required by the primary mission groups. Primary mission groups may be functional, such as combat, training, transport, or service. 2. A fleet air wing is the basic organizational and administrative unit for naval-, land-, and tender-based aviation. Such wings are mobile units to which are assigned aircraft squadrons and tenders for administrative organization control. 3. A balanced Marine Corps task organization of aircraft groups and squadrons, together with appropriate command, air control, administrative, service, and maintenance units. A standard Marine Corps aircraft wing contains the aviation elements normally required for the air support of a Marine division. 4. A flank unit; that part of a military force to the right or left of the main body. (JP 1-02)