CHAPTER VI

COMBAT IDENTIFICATION

A. DESCRIPTION

Combat Identification (CID) is the process of attaining an accurate characterization of entities in a combatant's area of responsibility to the extent that high-confidence, real-time application of tactical options and weapon resources can occur. The objective of CID is to maximize combat/mission effectiveness while reducing total casualties (due to enemy action and fratricide).

B. OPERATIONAL CAPABILITY ELEMENTS

U.S. forces must be able to positively identify all targets in the battlespace for all combat mission areas—air to air, air to surface, surface to surface, and surface to air. Surface includes land, sea, and subsurface—otherwise known as ground and maritime (Figure VI–1). The CID need is essential in order for commanders to effectively field, at any time, fighting forces that can rapidly and positively identify enemies, friends, and neutrals in the battlespace; manage and control the battle area; optimally employ weapons and forces; and minimize total casualties.

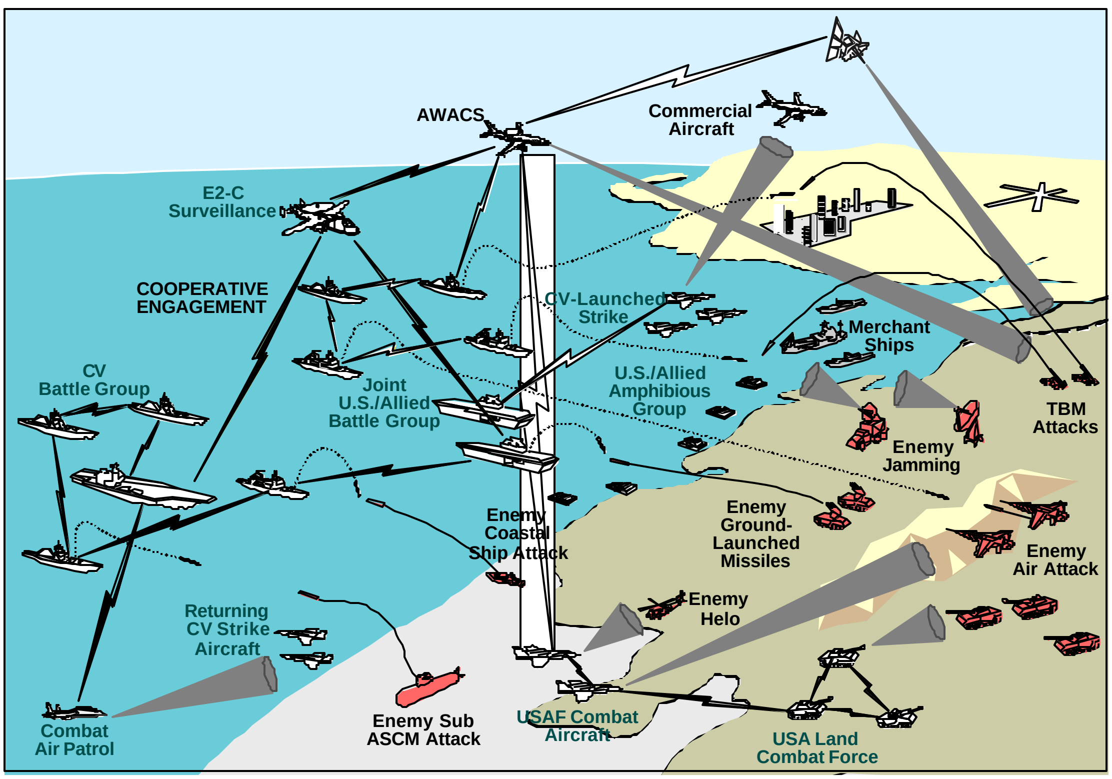


Figure VI–1. Concept—Combat Identification

In 1992, the Joint Requirements Oversight Council (JROC) validated the Joint Mission Need Statement (MNS), which describes the broad-based requirements for CID. The JROC revalidated the MNS in 1998. These include positive, timely, and reliable identification of friends, foes, and neutrals; classification of foes by class, type, and nationality; and interoperability required among the U.S. military and desired with allied nations. The challenges presented by the requirements necessitate a CID architecture that blends both nonmateriel and materiel solutions.

Nonmateriel solutions include doctrine; tactics, techniques, and procedures (TTP); and training. From a cost perspective, the nonmateriel solution to resolving a CID deficiency is compelling if it does not carry untenable constraints on the warfighter. However, nonmateriel solutions often need to be augmented by materiel solutions. These can be characterized as cooperative/noncooperative sensor systems and command, control, and communications (C^3) systems—in particular, digital datalinks and radios, each of which contributes a portion to the CID solution. As such, CID is viewed as a capability, not a single system or program. A “system-of-systems” approach is required.

CID is the result of a process that appropriately and accurately characterizes the entities present in a combatant’s area of responsibility. Effective CID can take place with varying degrees of target identification, depending on the conditions of the battlespace. At times, the extent of required identification is only to rapidly distinguish among friendly, neutral, and adversary forces with high enough confidence to support weapon employment decisions. At other times, identification of target class (e.g., cruise missile, fighter, or bomber) or target recognition (e.g., target vs. decoy) is required to select the correct defensive or offensive tactical weapon response. In other cases, a more extensive characterization that identifies specific target parameters, such as platform type (e.g., MiG–29 vs. MiG–21) and intent (e.g., an active interceptor vs. a defector), is required to select optimal defensive weapons and to support weapon release decisions. In all cases, the goal for CID is to provide the necessary level of identification to make correct weapon decisions. This CID approach supports the attainment of military objectives while minimizing total casualties.

The primary objective for CID is to correlate and assign a foe, friend, or neutral identification label to a “target.” The identification label can be assigned at any time from initial detection of the potential target to weapon employment. To be useful for a direct-fire engagement, the correct target label must be correlated to a sensor return that is in a “weapon sight” (e.g., radar, laser, or thermal sight). Indirect-fire weapons or supporting-fire weapons operate from a different perspective as they cannot “see” the target. The identification is made and sent to the weapon by the fire requester or a surveillance/reconnaissance platform; the weapon is correlated to the specified target position.

As discussed earlier, there are two classes of materiel solutions:

- *Sensors*—the target is characterized either noncooperatively (e.g., radar signal modulation, high-range resolution radar, or electronic support measures) or cooperatively (e.g., MK XII identification friend or foe (IFF) system or Battlefield Combat Identification System (BCIS)).

- C^3 *(particularly digital datalinks and radios)*—the target declares (either periodically or when queried) its identification and position in a reference frame that the "shooter" can correlate with its own weapon and sensor system (e.g., Link–16). Additionally, C^3 systems are a medium for passing ID information from other sensors or sources.

Both approaches have their strengths and limitations. If an offboard sensor performs the interrogation and identification, there is the added necessity to pass and correlate the required information in a timely fashion. This requirement to correlate an identification label with a sensor return in the "weapon sight" is a key discriminator and a source of significant cost for the systems.

The vision is a fielded CID capability that ensures that all combatant platforms will have available the required identification information in a timely fashion that is commensurate with the range and lethality of the platforms' weapons and sensors. The approach toward realizing this vision is through an integrated CID architecture that combines noncooperative and cooperative identification sensors and systems with C^3 (particularly digital datalinks and radios) capabilities. Such architecture supports the development of situational awareness—the overall, general knowledge of the tactical battlefield environment, including the location of friendly, neutral, and enemy forces as well as the plan of action for battle. The required operational capability will then be achieved by combining onboard data from multiple sensors and systems with indirectly supplied offboard information.

Due to the fundamental differences of their operating environments, the operational capability elements can be aggregated into three categories: air, ground, and maritime target platforms. Air platforms are more dispersed, move at much higher speeds, and are engaged at relatively long ranges with imaging or nonimaging sensors. Ground platforms are closely spaced, move slowly, and are engaged at close ranges also with imaging and nonimaging sensors. Maritime platforms are relatively slow compared with air platforms, can be either closely spaced (several hundreds of yards) or dispersed (several nautical miles), and are engaged at longer ranges than ground platforms due to the nonimaging sensors indigenous to the maritime platform or the imaging/nonimaging sensors of the aircraft attached to the maritime unit.

In general, the current CID capability against all platforms must be improved. The current CID capability in many cases does not allow for maximum use of a weapon's range and engagement of targets in highly mixed, fast-moving environments. Confining rules of engagement and necessary procedures and precautions often restrict combat effectiveness. For ground targets (air-to-surface and surface-to-surface mission areas), the current capability is extremely limited. The plan is to have an initial level of high-confidence CID capability fielded for all early-deploying, first-line combatant platforms within 10 years. The CID capability must provide the required identification information with very high confidence.

For air targets (surface-to-air and air-to-air mission areas) as well as maritime targets (surface-to-surface and air-to-surface mission areas), CID needs improvement in some areas. In some cases, effective systems have been developed that could fill some of the needs but are not widely fielded. In other cases, noncooperative sensor/technique databases need to be updated and more fully populated. In still other areas, correlation/fusion issues need to be resolved. The objective is to provide nearly perfect identification information.

The term *automatic target recognition* (ATR) is usually associated with the development or implementation of cooperative and noncooperative sensor systems for surface targets. The need for ATR systems stems from the increased complexity of tactical and strategic battlespaces, the unprecedented amount of raw information produced by modern sensor systems, and the effectiveness of C^3 systems. Collectively these can overwhelm the capability of human operators and decision makers. The magnitude and rate of information produced may exceed the operator's ability to absorb and process it in a timely fashion; performance declines with operator fatigue and varies with operator training. Consequently, ATR systems are being developed to provide an assortment of technological services that range from operator prompting (cueing) tools to fully automated recognition systems requiring no human operator intervention.

More precisely, the goal of ATR is to support rapid and reliable detection, geolocation, tracking, recognition, and prioritization of targets. In general, the output will provide a human operator or decision maker with target recommendations, weapon options, and the level of confidence associated with each proposed action.

The degree to which the constituent functions can or should be automated depends not only on the efficacy of the ATR technology but also on sensor performance, target complexity and density, target environment, mission requirements, and required response times. For example, particular mission or battlespace conditions may only require an ATR system to sort through a very large potential target density and alert an operator to the presence and location of a change in battlespace conditions (e.g., deployment of troop positions or bomb damage assessment) since the previous battlespace analysis. In this example, image analysts would be required to infer appropriate information from the data; such systems, which are predicated on active human participation, are sometimes referred to as *assisted target recognition* or *aided target recognition*.

In summary, ATR provides several enabling technologies for CID. The amount of automation that can be provided by ATR relates to the varying degrees of target identification required for a functional CID capability. For additional information on ATR, see *Defense Technology Area Plan* (Reference 3), Chapter VII, Sensors, Electronics, and Battlespace Environment.

C. FUNCTIONAL CAPABILITIES

The functional capabilities for CID include foe identification (including platform type, class, nationality, allegiance, and intent information), friend identification, neutral identification, and interoperability (for cooperative sensors, C^3 datalinks/radios, and databases on noncooperative sensors and techniques). The functional capabilities required to meet the CID operational capability elements and the strength of their support (in terms of efforts spent and focus of technological and programmatic activities) are shown in Table VI–1. The relative importance of these functional capabilities to the operational capability elements varies due to the fundamental differences in the missions and the operating environments of the potential targets.

Table VI–1. Functional Capabilities Needed—Combat Identification

Functional Capabilities	Operational Capability Elements: Air to Surface	Surface to Surface	Surface to Air	Air to Air
1. Foe Identification	●	●	●	●
2. Friend Identification	●	●	●	●
3. Neutral Identification	●	●	●	●
4. Interoperability	●	●	●	●

● Strong Support ○ Moderate Support

Noncooperative identification sensors and systems have the advantage of identifying foes, friends, and neutrals. Cooperative identification sensor systems, which only identify friendly units, have the advantage of less technical challenge; however, they require all friendly potential targets to be equipped with the same corresponding identification equipment. C^3 systems (particularly digital datalinks and radios) can provide (1) friend identification automatically (for all participants on the network), (2) a medium for passing foe/neutral identification generated from other sensors/sources, and (3) a medium for passing friend identification (for those platforms not on the network) generated from other sensors/sources. In addition to doctrine/TTP, all of these systems are critical contributors to a system-of-systems approach in providing both situational awareness and identification to use lethal weapons in the battlespace. The functional capabilities of all CID systems must work synergistically to provide a robust, high-confidence CID capability.

D. CURRENT CAPABILITIES, DEFICIENCIES, AND BARRIERS

The U.S. baseline varies according to operational capability element mission area. Some technological capabilities have not been fielded while others have only been fielded to a small segment of the force.

Current Air-to-Surface Capability

Foe Identification

- Visual identification.
- Use of tactical reconnaissance or surveillance aircraft to exploit electronic signals emitted by a set of targets (e.g., electronic support measures (ESM)).
- Recognition of classes of maritime platforms using inverse synthetic aperture radar (ISAR).
- Recognition of classes of ground platforms using synthetic aperture radar (SAR).
- Communication by ground or air forward air controller (FAC)—via voice or automated ground target information passing systems (e.g., Improved Data Modem or Automatic Target Handoff System)—for close air support (CAS) information, including target location and identification, nearest friendly position, and clearance to drop ordnance.

Friend Identification

- Visual identification.
- Use of marking schemes for ground platforms that can be readily detected visually or via available sensors.
- Query and identification of maritime platforms with cooperative sensor/C^3 system (e.g., MK XII Mode 4 or Link–16, the latter still being fielded).

Neutral Identification

- Visual identification only.

Interoperability

- Voice communications.
- Query and identification of maritime platforms with cooperative sensor/C^3 system (e.g., MK XII Mode 4 or Link–16, the latter still being fielded).

Current Surface-to-Surface Capability

Foe Identification

- Visual identification of ground and maritime platforms.
- Classification of maritime platforms via radar returns, exploiting electronic signals emitted by target (e.g., ESM).

Friend Identification

- Visual identification of ground and maritime platforms.
- Query and identification of potential targets with cooperative sensor/C^3 system (e.g., for ground platforms, the Battlefield Combat Identification System, in limited numbers; for maritime platforms, the MK XII Mode 4 or Link–16).
- Use of marking schemes for ground platforms that can be readily detected visually or via available sensors.
- Classification of maritime platforms via radar returns, exploiting electronic signals emitted by target (e.g., ESM).
- Improved location of friendly ground forces using Global Positioning System (GPS).

Neutral Identification

- Visual identification of ground and maritime platforms.
- Classification of maritime platforms via radar returns, exploiting electronic signals emitted by target (e.g., ESM).

Interoperability

- Voice communications.
- General location of friendly ground battle participants based on tactical digital radios, which are still being fielded, have mixed levels of interoperability, and are not yet based on joint common data element standards.

- Location of friendly maritime battle participants based on digital datalinks (e.g., legacy Link–11 and current/future Link–16), which have mixed levels of interoperability.

Current Surface-to-Air Capability

Foe Identification

- Visual identification.
- Classification of platform type via detailed analysis of radar return (e.g., radar signal modulation (RSM), radar painting).
- Exploitation of electronic signals emitted by target (e.g., ESM).

Friend Identification

- Visual identification.
- Query and identification of potential targets with cooperative sensor/C^3 system (e.g., MK XII Mode 4 or Link–16).
- Classification of platform type via detailed analysis of radar returns (e.g., RSM, radar painting).
- Exploitation of electronic signals emitted by targets (e.g., ESM).

Neutral Identification

- Visual identification.
- Classification of platform type via detailed analysis of radar return (e.g., RSM, radar painting).
- Exploitation of electronic signals emitted by target (e.g., ESM).

Interoperability

- Big picture of battlespace via Link–16 and other legacy datalinks that are not yet interoperable across services.
- Voice communications with other agencies and sensors.

Current Air-to-Air Capability

Foe Identification

- Visual identification.
- Classification of platform type via detailed analysis of radar returns (e.g., RSM, radar painting).
- Exploitation of electronic signals emitted by target (e.g., ESM).

Friend Identification

- Visual identification.
- Query and identification of potential targets with cooperative sensor/C^3 system (e.g., MK XII Mode 4 or Link–16).

- Classification of platform type via detailed analysis of radar returns (e.g., RSM, radar painting).
- Exploitation of electronic signals emitted by target (e.g., ESM).

Neutral Identification

- Visual identification.
- Classification of platform type via detailed analysis of radar returns (e.g., RSM, radar painting).
- Exploitation of electronic signals emitted by target (e.g., ESM).

Interoperability

- Big picture of battlespace via Link–16 and other legacy datalinks that are not yet interoperable across services.
- Voice communications with other agencies and sensors.

Addressing the issue of C^3/digital datalink and radio interoperability, the United States is migrating toward a J–series family of datalinks to include Link–16 for air operations, Link–22 for maritime operations, and joint variable message format (VMF) for ground operations. All datalinks and digital radios are to comprise J–series (based on the Tactical Air Digital Information Link J (TADIL–J)) protocols and message sets to facilitate communications across the battlespace. For air, maritime, and ground weapons, doctrine/TTP plays a significant role in sorting friend from foe or neutral in the battlespace.

The JROC has reviewed the CID joint warfighting needs by mission areas and has stated a need for CID in all mission areas. Additionally, the JROC ranked the mission areas in terms of available CID equipage from the most deficient to the least deficient as follows:

- Air to surface
- Surface to surface
- Surface to air
- Air to air.

The JROC noted that many U.S. platforms are currently deficient in CID systems and datalinks. No ground combatants have a long-range identification capability, and many maritime and air platforms have only limited CID suites.

There are two principal barriers to having universal CID capability on all air, maritime, and ground platforms: affordability and signature exploitability.

Affordability. The costs of CID suites that are properly integrated with the weapon sight (both cooperative and noncooperative) are usually prohibitive if they are not a P^3I of an existing sensor or system. Additional functionality in the form of intelligence, communications, situational awareness, or sensing/detection is helpful in making CID more affordable as it is being used to meet numerous other operational needs and objectives. The affordability of a CID system will also vary significantly depending on the environment in which it is considered. Aviation/maritime systems are generally more expensive than ground-based systems, especially in the area of platform integration. Leveraging planned or programmed platform modifications of other systems onto platforms shares the integration costs with other programs, thereby lowering not only the total cost but also the net and delta CID costs. Alternatively, for ground combat vehicles, although system and integration costs are appreciably lower, there are many more platforms involved, so the total cost can also be prohibitively expensive if system costs are not held to a minimum. Technology that eases the integration overhead of a CID-related system or reduces its component cost is required.

Signature Exploitability. Noncooperative techniques of identification are attractive to warfighters due to their ability to generate labels for foe, friend, and neutral contacts, and because they can provide additional identification information on adversaries (e.g., platform type, class, nationality). For air/maritime targets, the current capabilities of these systems are limited in range, aspect, and timeliness of reporting. The result is that the indications from this class of systems are frequently in the "unknown" or "not available" state. Improvements in sensors and target databases that expand the envelope of performance for these systems are necessary. For combat vehicles, the signal environment is such that reliable identification at maximum weapon range remains a significant technical challenge. Limitations in sensor resolution—coupled with variations in target aspect, state, countermeasures, and the battlespace signal propagation environment—complicate the job of target labeling. Technology improvements for improved sensors and ATR that can interpret imaging and nonimaging sensor data to reliably identify the platform type are necessary. The key technologies for reaching the combat identification joint warfighting capabilities are shown in Table VI–2. A number of Defense Technology Objectives (DTOs) in the Sensors, Electronics, and Battlespace Environment area of the DTAP also support CID: Advanced Radar Processing From Airborne Platforms (SE.03); Automatic Radar Periscope Detection and Discrimination (SE.05); Next-Generation Multifunction Electro-Optical Sensor System (SE.06); Multiwavelength, Multifunction Laser (SE.09); Lightweight, Broadband, Variable-Depth Sonar (SE.13); Multistatic Active Antisubmarine Warfare (SE.14); Affordable ATR via Rapid Design, Evaluation, and Simulation (SE.19); ATR for Reconnaissance and Surveillance (SE.20); Advanced Focal Plane Array Technology (SE.33); Multiphenomenology Sensor Fusion for ATR and Tracking (SE.61); Long-Wavelength and Multispectral, Large-Area, Staring Focal Plane Arrays (SE.65); Hyperspectral Applications Technology (SE.67); Advanced Multifunction RF System Components (SE.71); Precision Surveillance and Targeting Radar (SE.75); Battlespace Electronic Mapping (SE.82); Multisource Integration and Data Fusion (SE.83); and EO Target Detection, Location, and Noncooperative ID (SE.85).

CID can be most useful when it is fully integrated with both C^3 and weapon systems. It often develops time-urgency far exceeding that for most other C^4I functions. In addition, CID requirements and procedures need to be refined through simulation and military exercises. If not defined within that sort of environment, past history suggest that some requirements will be so stringent as to discourage serious development, while others may not be sufficient to satisfy the needs.

CID requires effective and timely synchronization of communications systems with data from real-time surveillance, target tracking, and intelligence systems. The CID output must be coupled with the weapon systems in real time to maximize their effectiveness against enemies. In the past, inability to take advantage of all available information has made CID systems add-ons rather than integrated features of all tactical systems.

CID capabilities are also vulnerable to enemy exploitation or countermeasures. Vulnerability analyses and evaluations must accompany system design and test programs.

Table VI–2. Goals, Limitations, and Technologies—Combat Identification

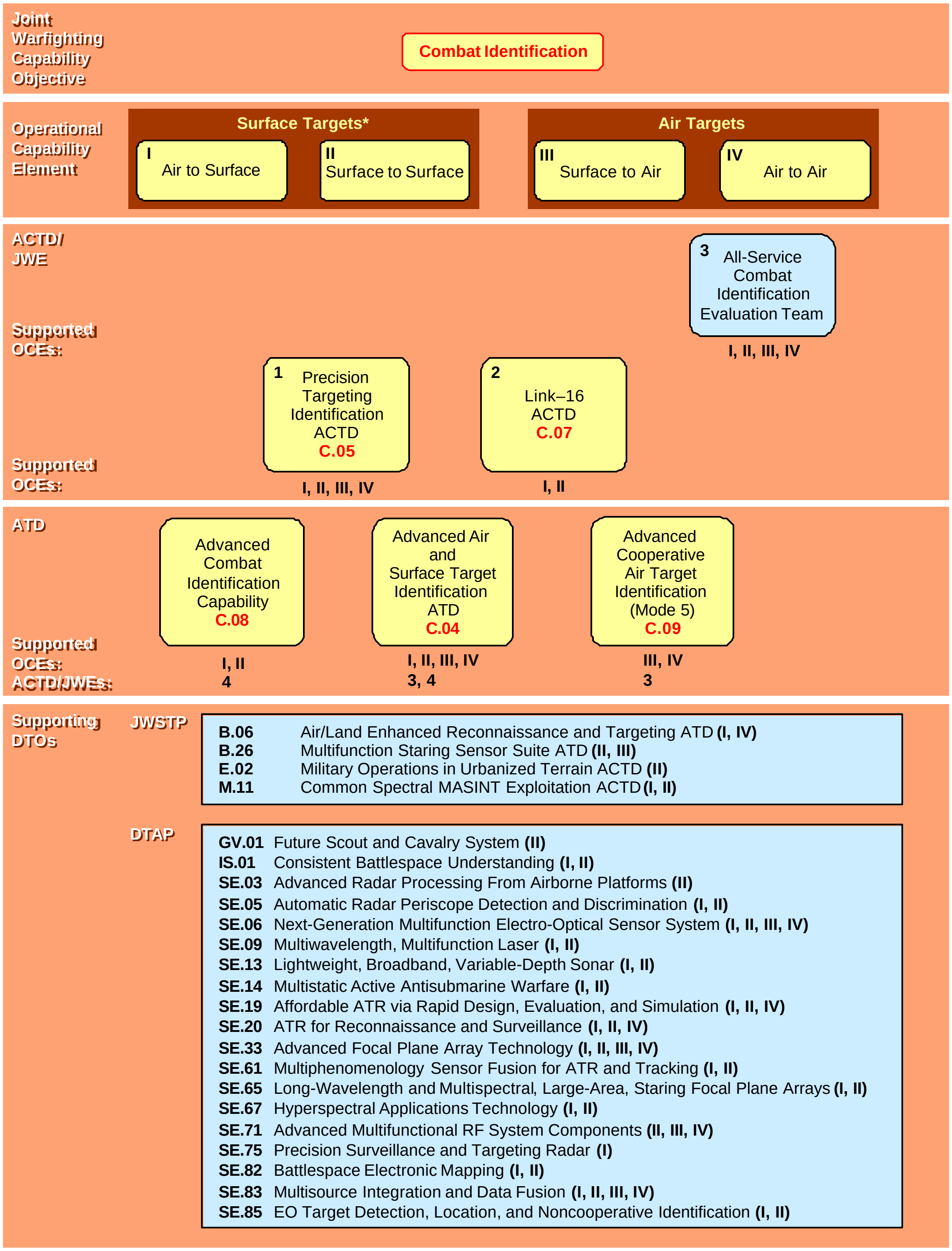
Goal	Functional Capabilities	Limitations	Key Technologies
Operational Capability Element: Air to Surface			
Robust, high-confidence ID capability at range commensurate with range and lethality of weapons Maximum military effectiveness of combatants Minimum total casualties due to enemy action and fratricide Automated position reporting and correlation for battlespace (i.e., datalink capability) Interoperability Secure operations Nonexploitability Reliable, low-false-alarm periscope detection and geographic location	Foe identification Friend identification Neutral identification Interoperability	Technology limitations (range, ID, accuracy, aspect dependency, timeliness of reporting) CC&D Lack of standardized datalink Affordability Vulnerability	Fusion Database management Moving surface target imaging radar Radar imaging/processing Laser radar development/ processing IR focal plane array Advanced IR sensors Multi/hyperspectral processor ESM Secure datalinks ATR development Target phenomenology and modeling Sonar/acoustic signal processing
Operational Capability Element: Surface to Surface			
Robust, high-confidence ID capability at range commensurate with range and lethality of weapons Maximum military effectiveness of combatants Minimum total casualties due to enemy action and fratricide Automated position reporting and correlation for battlespace (i.e., datalink capability) Interoperability Secure operations Nonexploitability Reliable, low-false-alarm periscope detection and geographic location	Foe identification Friend identification Neutral identification Interoperability	Technology limitations (range, ID, accuracy, aspect dependency, timeliness of reporting) CC&D Lack of standardized datalink Affordability Vulnerability	Fusion Database management Radar imaging/processing Laser radar development/ processing IR focal plane array Advanced IR sensors Multi/hyper spectral processor ESM Secure datalinks ATR development Target phenomenology and modeling Low-cost north reference unit/ inclinometer Sonar/acoustic signal processing Millimeter-wave signal modulation and processing

Table VI–2. Goals, Limitations, and Technologies—Combat Identification (continued)

Goal	Functional Capabilities	Limitations	Key Technologies
Operational Capability Element: Surface to Air			
Robust, high-confidence ID capability at range commensurate with range and lethality of weapons Maximum military effectiveness of combatants Minimum total casualties due to enemy action and fratricide Automated position reporting and correlation for battlespace (i.e., datalink capability) Interoperability Secure operations Nonexploitability	Foe identification Friend identification Neutral identification Interoperability	Technology limitations (range, ID, accuracy, aspect dependency, timeliness of reporting) Lack of standardized datalink Affordability Vulnerability	Fusion Database management Radar imaging/processing Laser radar development/ processing ESM Secure datalinks Target phenomenology and modeling Acoustic signal processing RF signal modulation and processing
Operational Capability Element: Air to Air			
Robust, high-confidence ID capability at range commensurate with range and lethality of weapons Maximum military effectiveness of combatants Minimum total casualties due to enemy action and fratricide Automated position reporting and correlation for battlespace (i.e., datalink capability) Interoperability Secure operations Nonexploitability	Foe identification Friend identification Neutral identification Interoperability	Technology limitations (range, ID, accuracy, aspect dependency, timeliness of reporting) Lack of standardized datalink Affordability Vulnerability	Fusion Database management Radar imaging/processing Laser radar development/ processing ESM Secure datalinks Target phenomenology and modeling RF signal modulation and processing

E. TECHNOLOGY PLAN

The roadmap for developing and demonstrating these technologies has two main elements: surface target identification and air target identification. Each element addresses both the affordability and signature exploitability barriers. An overview of the relationship of the CID operational capability elements, functional capabilities, demonstrations, and supporting technologies is shown in Figure VI–2. Evaluations and demonstrations of technologies can be provided in exercises conducted by, for example, the All-Service Combat Identification Evaluation Team (ASCIET). ASCIET can evaluate current CID concepts and TTP while simultaneously providing a venue for emerging technology development.



*Surface = Ground + Maritime

Figure VI–2. Technology to Capability—Combat Identification

The primary DTOs and their corresponding demonstrations that address the CID operational capabilities are shown in Table VI–3. The Military Operations in Urbanized Terrain (MOUT) ACTD (E.02), which will explore small-unit operations in an urban environment, will address some CID issues; and the Future Scout and Cavalry System (GV.01), which will demonstrate the operational potential of a lightweight scout vehicle integrating scout-specific technologies with complementary advanced vehicle technologies, will also include some CID aspects. The Common Spectral MASINT Exploitation ACTD (M.11) will support the Precision Targeting Identification ACTD (C.05) (see below) and will help identify vehicle class and friend/foe even through camouflage. The DTO roadmap is shown in Figure VI–3. Below is a list of the primary DTO efforts:

- *C.04, Advanced Air and Surface Target Identification ATD*, will develop and demonstrate advanced, air-to-surface and air-to-air noncooperative target ID capabilities for use on current and next-generation aircraft. The system produced by this DTO will provide long-range, high-confidence identification at ranges commensurate with current and advanced weapon suites.
- *C.05, Precision Targeting Identification (PTID) ACTD*, will demonstrate the standoff-aspect invariant classification of aircraft and surface targets with a low probability of intercept. This DTO will attempt to improve capabilities in three warfare mission-critical areas: positive ID of noncooperative air targets, over-the-horizon targeting, and battle damage assessment.
- *C.07, Link–16 ACTD*, will provide interoperability between the Link–16 (used in air and maritime operations) and VMF (used in ground operations) networks. This DTO will attempt to reduce or eliminate the occurrence of delayed, incorrect, or incomplete delivery of critical battlespace information caused by current translators and gateways used for communicating between Link–16 and VMF systems.
- *C.08, Advanced Combat Identification Capability*, will advance the CID capabilities developed in the Joint Combat ID ACTD. This ACTD will focus on developing CID capabilities for mission pairings that were not previously studied (such as the vehicle-to-soldier pairing) and will also attempt to improve the Battlefield Combat Identification System (BCIS) capability for far-term (currently a mid-term technology) surface target identification. This ground element first addresses an integrated air-to-surface (ground, CAS) and surface-to-surface CID capability through the recently completed CID ACTD (C.02) and the associated EW, sensor fusion, and integrated situation assessment technology demonstrations. These demonstrations combine primarily friend identification with improved battlefield situational awareness and digital radio systems resulting from the Army's Force XXI initiative. The North Finding Module demonstration addresses a key technology needed for affordable correlation of identification labels within the weapon sight on ground platforms.

Table VI–3. Demonstration Support—Combat Identification

Demonstration	Operational Capability Elements: Air to Surface	Surface to Surface	Surface to Air	Air to Air	Service/ Agency	DTO	Type of Demonstration: ACTD	ATD
Advanced Air and Surface Target Identification ATD	●	○	○	○	Air Force, Navy	C.04		X
Precision Targeting Identification ACTD	●	○	●	●	Navy	C.05	X	
Link–16 ACTD	●	●			Joint	C.07	X	
Advanced Combat Identification Capability	●	●			Army	C.08		
Advanced Cooperative Air Target Identification (Mode 5)			●	●	Navy	C.09		
Air/Land Enhanced Reconnaissance and Targeting ATD	●			○	Army	B.06		X
Multifunction Staring Sensor Suite ATD		●	○		Army	B.26		X
Military Operations in Urbanized Terrain ACTD		●			Joint	E.02	X	
Common Spectral MASINT Exploitation ACTD	●	●			Air Force	M.11	X	
Future Scout and Cavalry System		●			Army	GV.01		
Consistent Battlespace Understanding	●	●			Air Force, Army	IS.01		
Advanced Radar Processing From Airborne Platforms		●			Air Force	SE.03		
Automatic Radar Periscope Detection and Discrimination	○	●			Navy	SE.05		
Next-Generation Multifunction Electro-Optical Sensor System	●	●	●	●	Navy	SE.06		
Multiwavelength, Multifunction Laser	●	●			Air Force	SE.09		
Lightweight, Broadband, Variable-Depth Sonar	○	●			Navy	SE.13		
Multistatic Active Antisubmarine Warfare	○	●			Navy	SE.14		
Affordable ATR via Rapid Design, Evaluation, and Simulation	●	●		●	Army	SE.19		
ATR for Reconnaissance and Surveillance	●	●		●	DARPA	SE.20		
Advanced Focal Plane Array Technology	●	●	●	●	DARPA	SE.33		
Multiphenomenology Sensor Fusion for ATR and Tracking	○	●			Air Force, Army	SE.61		
Long-Wavelength and Multispectral, Large-Area, Staring Focal Plane Arrays	○	●			Air Force, Army	SE.65		
Hyperspectral Applications Technology	●	●			Air Force, Navy	SE.67		
Advanced Multifunctional RF System Components		●	●	●	Air Force, Army, Navy	SE.71		
Precision Surveillance and Targeting Radar	●				Navy	SE.75		
Battlespace Electronic Mapping	●	●			Army, Navy	SE.82		
Multisource Integration and Data Fusion	○	○	○	○	Navy	SE.83		
EO Target Detection, Location, and Noncooperative Identification	○	●			Army	SE.85		

● Strong Support ○ Moderate Support

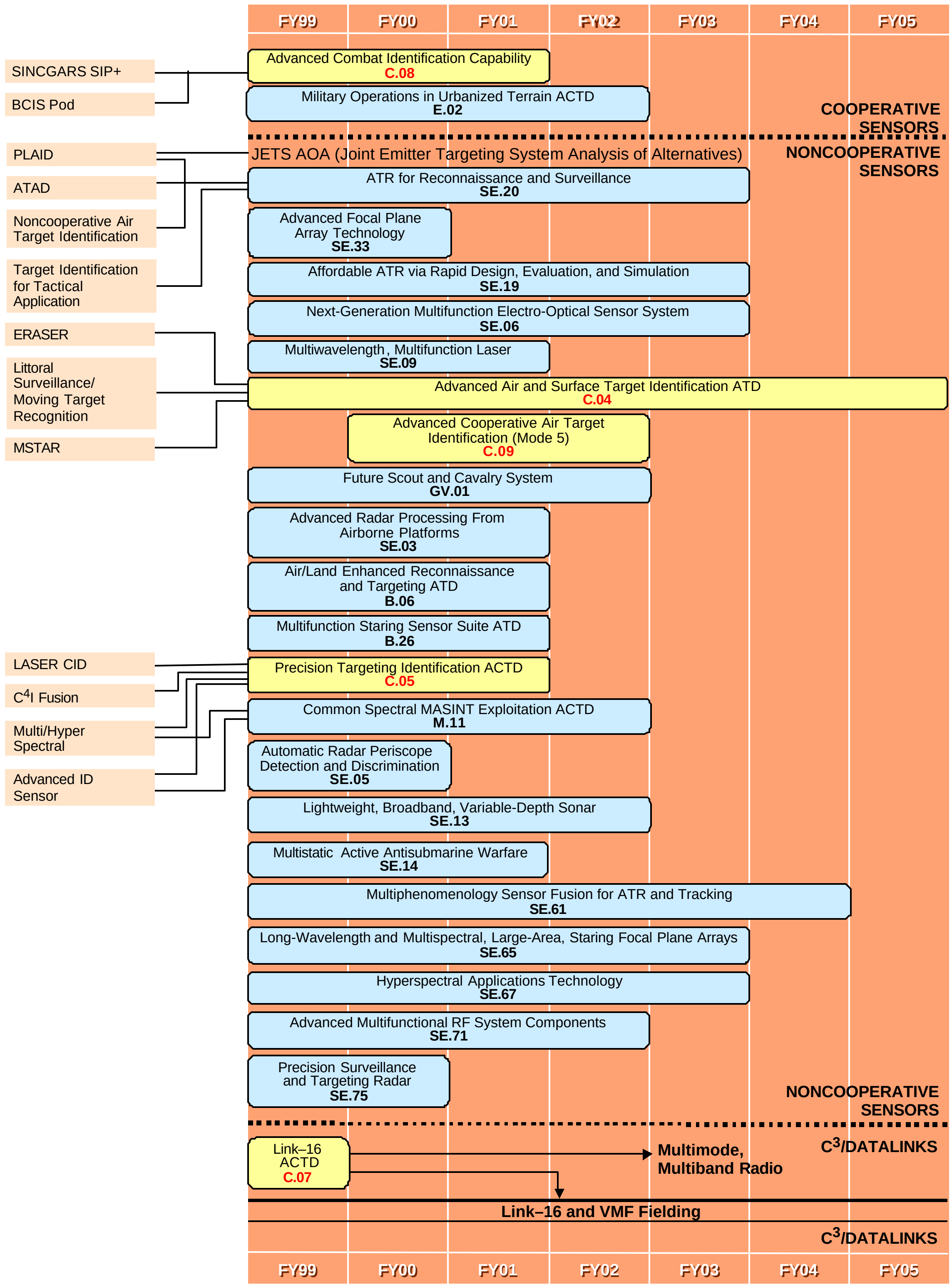


Figure VI–3. Roadmap—Combat Identification

- *C.09, Advanced Cooperative Air Target Identification (Mode 5),* will develop and demonstrate an advanced cooperative air target identification capability that can overcome the deficiencies of current cooperative identification technology and satisfy the friendly platform identification needs for air-to-air and surface-to-air engagements. This Navy effort will leverage existing military, air traffic control, and COTS technologies to provide affordable, secure, and reliable identification of air targets in a joint or coalition environment. The technology demonstration will provide the warfighter with an integrated air-to-air and surface-to-air capability to enhance combat effectiveness and reduce fratricide.

Surface Target Identification. This element first addresses an integrated air-to-surface and surface-to-surface CID capability through the Advanced Combat Identification Capability (C.08), and the associated EW/sensor fusion/integrated situation assessment technology demonstrations. These demonstrations combine primarily friend identification with improved battlefield situational awareness.

The next several steps focus on foe identification using noncooperative techniques. A number of ATDs are critical to this effort, including the Air/Land Enhanced Reconnaissance and Targeting (ALERT) ATD (B.06) and the AGRI component of the Advanced Air and Surface Target Identification ATD (C.04). Furthermore, the DARPA/Air Force Moving and Stationary Target Acquisition and Recognition (MSTAR) program and the Air Force System-oriented High-range-resolution Automatic Recognition Program (SHARP) support the Advanced Air and Surface Target Identification ATD (C.04). Maritime targets are also being addressed as part of the Precision Targeting Identification ACTD (C.05). Additionally, specific emitter identification (SEI) is being developed and procured as a “fingerprint” NCTI and tracking technology. Improving the ease of integration will allow for the CID solutions that are evolving or extant to be hosted within the architecture with a minimal expenditure of time or money. This element addresses the integration of multiple functions within a CID suite to reduce costs and improvements in the case of physical and functional integration onto combat platforms to achieve more rapidly deployable and affordable CID solutions.

Air Target Identification. The air target identification element represents a more information-rich approach. This element includes fusion, cooperative, and NCTI techniques. The air target identification is being addressed under Advanced Air and Surface Target Identification ATD (C.04) and Advanced Cooperative Air Target Identification (Mode 5) (C.09). Additionally, SEI is being developed and procured as a “fingerprint” NCTI and tracking technology.

Datalinks. A new effort is underway to link the air/maritime environments to the ground environment via the Link–16 ACTD (C.07). This ACTD provides interoperability between the Link–16 and VMF networks in support of air-ground and maritime-ground attack missions. Different datalink message formats and communications media have resulted in untimely, incorrect, or incomplete delivery of crucial battlefield information due to the use of translators/gateways to make these systems “communicate” with one another. Currently, it is difficult to establish seamless information flow among diverse datalink units. A major goal of this ACTD is to start standardizing C^4I messaging and data elements used to provide a seamless, flexible datalink environment. The objective is to demonstrate a joint, integrated capability to pass tactical information seamlessly among Link–16 and VMF networks. The various U.S. services and potentially some of our NATO allies will demonstrate this ACTD.

All CID techniques have a limited period of operational effectiveness before they are degraded or compromised by enemy countermeasures. It is therefore necessary to have an ongoing process to overcome these vulnerabilities by developing new technologies for CID, demonstrating new capabilities in appropriate operational environments, and deploying new or upgraded CID appliqués to maintain a superior operational CID capability.

Identification issues associated with weapons of mass destruction (WMD) are addressed in Chapter XII, Chemical/Biological Warfare Defense and Protection, and Counter Weapons of Mass Destruction.

F. SUMMARY

Providing an accurate CID capability when and where it is needed requires an integrated architecture that includes noncooperative/cooperative identification sensor systems, C^3 systems, and doctrine/TTP. Improvements in joint warfighting operational capabilities will be demonstrated using suites of the materiel capabilities on various platforms in joint operational environments.

A significant initial improvement is expected for ground target identification with the inception of new cooperative identification techniques combined with C^3/digital datalinks and radios. This will later be augmented with a foe and neutral identification capability for selected weapon systems.

Air and maritime target identification improvements will be achieved by increasing the robustness of overall CID capabilities by improving cooperative/noncooperative techniques, providing more capable datalinks, adding data fusion/correlation capabilities, and expanding the number of platforms equipped. The improvements in demonstrated warfighting capabilities over time are shown in Figure VI–4.

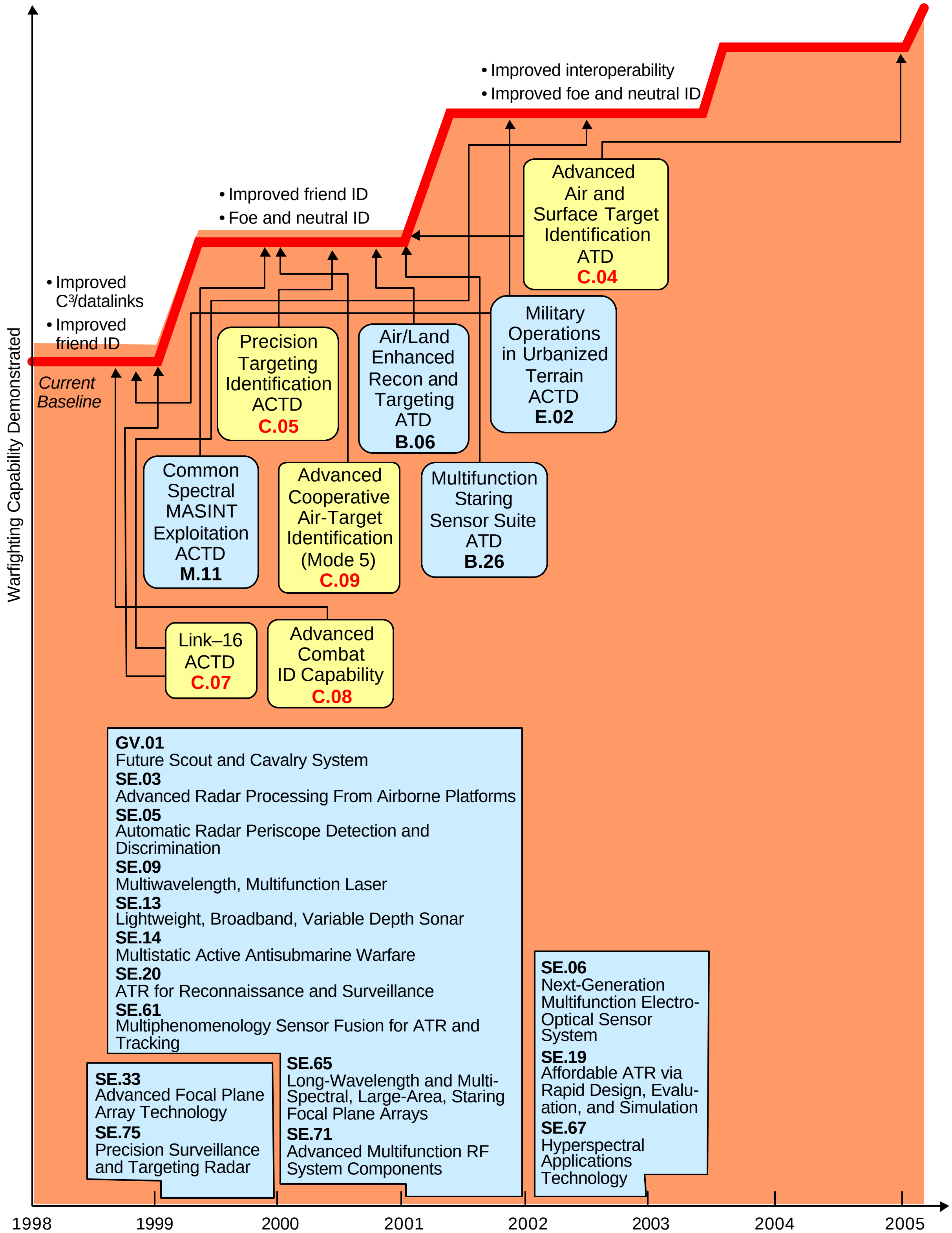


Figure VI–4. Progress—Combat Identification