A wide range of items and systems provide today’s warfighter with contamination avoidance, protection, decontamination and obscuration capabilities. Several representative examples are provided below.

Contamination Avoidance

The United States has fielded several types of nuclear detection and monitoring systems to assist in contamination avoidance. A family of radiological detection indication and computation (Radiac) equipment is being fielded to U.S. forces to upgrade 30-year-old technology with digital equipment that incorporates advances in modern electronics.

Radiac provides soldiers and commanders with nuclear radiation detection equipment, allowing them to fight effectively and survive on the nuclear battlefield. It also minimizes nuclear radiation exposure of troops during such peacetime missions as peacekeeping, nuclear-accident response, and recovery of vehicles and equipment containing radioactive material.

The AN/UDR-13 Radiac Set is a compact, handheld, pocket-size tactical radiation meter, which measures and displays gamma dose rate and total gamma/neutron cumulative dose in a battlefield environment.

A push-button pad enables mode selection, functional control and the setting of audio and visual alarm thresholds for both dose rate and mission dose. A “sleep” mode with automatic wake-up enhances battery life. A liquid crystal display provides data readout and warning-mode messages. As a replacement for the older IM-93/PP-1578, UDR-13 improvements include prompt dose measurement, including neutrons, alarms and rate measurement; backlit display; and stable readings and calibration. It does not need a separate charger.

The AN/VDR-2 Radiac Set detects and measures nuclear radiation from fallout and radioisotopes. The system replaces the older IM-174 and AN/PDR-27. It performs ground radiological surveys from vehicles or, in the dismounted mode, as a handheld instrument. The set can also provide a quantitative measure of radiation to help personnel, equipment and supply decontamination operations.

Components of the Radiac set include the Radiac meter IM-243, probe DT-616 and a pouch with strap. Kits are available as common table of allowances items for installation of the Radiac set in various military vehicles.

The set includes an audible and/or visual alarm that is compatible with vehicular nuclear-biological-chemical (NBC) protective systems in armored vehicles, and it also interfaces with vehicular power systems and intercoms.

The AN/PDR-75 Radiac Set measures the prompt and residual gamma doses and neutron doses stored on the DT-236 individual dosimeter from 1 to 1,000 centigray (cGy). The system provides a new operational capability to monitor and record the total dose exposure of individual personnel to gamma and neutron radiation. It measures total neutron and gamma doses from 0 to 1,000 cGy, and it responds to and measures prompt radiation from nuclear
bursts. It will be used to calculate unit radiation status and to perform medical triage and assist in unit reconstitution.

The **AN/PDR-77 Radiac Set** detects and measures alpha, beta, gamma and X-ray radiation. The system replaces the older AN/PDR-56F and AN/PDR-60, which relied on aging technology and were not sensitive enough to accomplish the Army's alpha detection mission.

The **M21 Automatic Chemical Agent Alarm** is the first standoff chemical agent detector approved for fielding to the soldier. It gives early warning of blister and nerve agents up to 5 kilometers, thus allowing field commanders to identify and maneuver around contaminated areas. An automatic scanning, passive infrared sensor, it detects agent vapor clouds by changes that the vapor causes in the background infrared spectra. Scanning a 60-degree arc, the M21 sounds a horn and illuminates either a blister or nerve light. It is fielded in tripod-mounted configurations as well as mounted on a mast on the M93A1 Fox NBC reconnaissance system.

The **M22 Chemical Agent Alarm** is an off-the-shelf alarm system capable of detecting and identifying standard blister and nerve agents. The M22 used the foreign comparative testing program for down-selection of the United Kingdom’s GID-3. The M22 system is manportable, operates independently after system start-up, and provides an audible and visual alarm.

The **Multipurpose Integrated Chemical Agent Alarm (MICAD)** is an integrated nuclear, biological and chemical detection warning and reporting system to be used in area warning, combat and armored vehicles, and tactical van and shelter mission profiles. MICAD automates the currently laborious NBC warning-and-reporting process throughout the battlefield. It automates the gathering of NBC contamination data from fielded NBC detectors and sensors and automatically formats and transmits alarms and reports up the chain of command throughout the battlefield.

MICAD provides a communications interface to NBC sensors, provides warnings of chemical and nuclear attacks throughout the battlefield and automatically generates NBC-1/NBC-4 reports over existing tactical communications. It operates with the M22 and an AN/VDR-2 Radiac set. It interfaces with global positioning system (GPS) vehicle navigation systems and modular collective protection equipment; it automates NBC report preparation (NBC-1/NBC-4) and transmission; and it communicates via single-channel ground and air radio system, FBCB2 or JWARN. Its flexible design allows its use in an area warning role with telemetry link radio.
Communications interface for automatic battlefield warning and reporting. The M22 is an improvement over the M8A1 automatic chemical agent alarm system in four major areas: It provides simultaneous detection and warning of nerve and blister agents; it is significantly more sensitive than the M8A1; it can operate in a collective protection environment; and it is much less responsive to interference, thus reducing false alarms. The M22 is currently fielded to the Army, Navy, Air Force and Marine Corps.

The Chemical Agent Monitor (CAM) and the Improved CAM (ICAM) provide a means of quickly locating the presence or absence of nerve- and mustard-agent contamination on personnel and equipment. CAM is a handheld device used by troops in full protective clothing after an attack or exposure to a contaminated area. It provides fast low-level detection of nerve and mustard vapors, differentiates between nerve and mustard agents, provides an indication of the relative magnitude of the hazard present and is not affected by most common forms of battlefield interference.

The use of the CAM on a chemical battlefield lowers the risk commanders may have to take when reducing the level of mission-oriented protection posture in a combat situation. CAM gives commanders the ability to quickly monitor for contamination, thereby allowing soldiers and equipment to remain engaged in their combat missions. CAM is also used to check the effectiveness of decontamination operations.

Like CAM, ICAM is a handheld, soldier-operated, post-attack device for monitoring chemical agent contamination. It detects chemical agent vapors by sensing molecular ions of specific mobilities (time of flight), and uses timing and microprocessor techniques to reject interference. The monitor detects and discriminates among nerve and mustard agent vapors. ICAM consists of a drift tube, signal processor, molecular sieve, membrane, confidence tester, dust filters, buzzer and battery pack.

The monitor measures 4 inches by 7 inches by 15 inches and weighs approximately 5 pounds. ICAM differs from CAM in its greater reliability (an estimated 300 percent improvement), faster start-up time (one-tenth of the time) and significantly reduced maintenance costs (an estimated $135 million cost savings over the life of the system).

The Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD) is a new detection system designed to provide American 21st-century warfighters with state-of-the-art capability in detecting nerve, blister and blood agent vapor clouds. JSLSCAD is a fully automatic detection system that searches the surrounding atmosphere for chemical agent vapor clouds. It is the first chemical vapor detection system to furnish 360-degree on-the-move coverage from ground-, air- and sea-based platforms at average distances of 2 kilometers. JSLSCAD will provide warfighters of the four armed services with early warning to avoid contaminated battlespaces or, if avoidance is not possible, time to don protective masks and clothing.

Intended JSLSCAD applications include various ground vehicle, shipboard and fixed-emplacement platforms including M93A1 Fox vehicle, NBC Reconnaissance Vehicle (NBCRV), ships and fixed-site installations. The design of the JSLSCAD provides for communication with the NBC Joint warning and reporting network (JWARN).

Smoke/Obscurants

Smoke and other obscurants have been used in wars dating back to ancient Greece. On today’s battlefield, smoke can counter new generations of smart weapons. Smoke is used as camouflage, as blinding smoke laid directly on enemy positions, and as a decoy to confuse and mislead enemy forces. These basic smoke applications are used to increase survivability, buy maneuver time for the attacker, and protect forward-assembly areas and high-priority rear areas for the defense.

Smoke particles scatter or absorb radiant energy used by troops and smart weapons for target acquisition and for weapon guidance and control. Smart-weapon sensors operate in three main parts of the electromagnetic spectrum: visible; near-, mid- and far-infrared wavelengths; and millimeter wavelengths.

The most effective scattering smokes are aerosols that are the same size as the operating wavelengths of the sensor to be defeated. The best smoke for the visible spectrum may be transparent in the far-infrared area. The entire chain of electro-optical, infrared and millimeter-wave devices linking a smart weapon to a target is susceptible to smoke and other obscurants. In addition to absorbing light, some smokes emit heat, which can cover or clutter the thermal images of targets.

The reflection of laser or radar beams from smoke clouds can produce false targeting information for smart weapons, which can be blinded and defeated by smoke. Battlefield obscurants allow combatants to take advantage of technology overmatch. In Operation Desert Storm, U.S. ground forces used infrared-viewer technology at night to achieve dramatic results.

The Army uses several models of smoke-generation systems, including the M56 Coyote, the M58 Wolf, the M157A2 Lynx and the M1059/M1059A3 Lynx. In addition, the M6 countermeasure discharger provides self-screening protection to individual combat vehicles.

The M56 Coyote Smoke-Generation System (SGS) provides large-area obscuration in the visible and infrared spectra. It is a Humvee-mounted, large-area, smoke-generator system. In addition to providing enhanced spectrum coverage, the M56 system provides smoke generators with a new wheeled-vehicle platform.

The M56 Coyote was type-classified “standard” in September 1994 and was followed by an initial production contract.
award for 296 systems in March 1995. First-article and production verification testing were successfully completed in September 1996.

By the end of February 2000, 231 systems had been fielded to U.S. Army Training and Doctrine Command, U.S. Army Forces Command (FORSCOM) and U.S. Army Reserve Command (USARC). Fielding continues to FORSCOM and USARC.

A materiel change program to add a millimeter-wave module provides extended spectral coverage to defeat threat weapon systems operating in the millimeter regions of the electromagnetic spectrum.

The M58 Wolf Smoke-Generation System places the capabilities of the M56 on a derivative of the tracked M113 armored personnel family.

The M58 Wolf was type-classified in August 1995. Following a successful production verification test, the Wolf received materiel release approval in the first quarter of fiscal year (FY) 1998 and has been successfully fielded. It was fielded to Army Reserve units, along with training, late in FY 2000.

The M157A2 Lynx Smoke-Generation System lets Army forces on the move produce large-area visual smoke screens. The system uses dual-pulse engines operating on standard Army fuels to produce large clouds of fog-oil vapor to defeat visual range observation and tracking methods, including lasers.

Its major components are two M54A2 smoke generators, an air compressor assembly, a 120-gallon fog-oil tank, a fog-oil pump assembly and a remote-control panel. The entire package is mounted on the rear of an M1037/M1097 Humvee with an M284A1 mounting kit.

The M1059/M1059A3 Lynx Smoke-Generator Carrier is an M113A2 armored personnel carrier modified to transport a single M157 smoke-generating set. The two generators, mounted on the roof of the vehicle under armor, are remotely controlled from inside the vehicle.

The M6 Countermeasure Discharger is a four-tube smoke grenade launcher that enables combat vehicles to conceal themselves from hostile surveillance, target acquisition and weapon guidance systems. The M6 can fire all Q-STAG 401 conforming grenades (66 mm) and interfaces with vehicle integrated defense systems.

Biological Detection

The M31A1 Biological Integrated Detection System (BIDS) mitigates the effects of biological warfare attacks during all phases of a campaign. As a corps-level asset, it is employed by a dedicated biological defense company to detect large-area biological attacks.

The BIDS network provides the basis for warning and confirming that a biological attack has occurred. The system provides presumptive identification and produces a safety-configured sample for later laboratory analysis.

The M31A1 detection system is made up of a shelter (S788 lightweight multipurpose shelter) mounted on a dedicated vehicle (M1097 heavy Humvee) and equipped with a biological detection suite. The systems include a trailer-mounted 15-kilowatt generator (PU-801) to provide electrical power, a GPS receiver (AN/PSN-11 PLGR), tactical and long-range communications equipment (SINCGARS and Harris HF radios) and a meteorological sensor.

BIDS uses multiple complementary technologies to detect various characteristics of a biological aerosol attack. BIDS integrates aerodynamic particle sizing, luminescence, fluorescence, flow cytometry, mass spectrometry and immunoassay technologies in a hierarchical, layered manner to increase detection confidence and system reliability. BIDS detects all types of biological agents and identifies specific agents of interest. The system can be easily upgraded or modified to identify other additional agents, based on changes in threat conditions. BIDS will detect any eight agents in less than 10 minutes and identify them, simultaneously, in less than 30 minutes. The
The M93A1 Fox Nuclear-Biological-Chemical Reconnaissance System (NBCRS) is a dedicated system of nuclear and chemical sampling, detection and warning equipment, and biological sampling equipment integrated into a high-speed, high-mobility, six-wheel armored vehicle. It is capable of performing NBC reconnaissance on primary, secondary or cross-country routes throughout the battlefield. The M93A1 is the Block 1 improvement of the M93 FOX NBCRS Interim System to meet all of the requirements of the approved required operational characteristics and reduces the crew size to three. It is capable of detecting chemical contamination in its immediate environment through point detection, and at a distance through the use of a standoff detector (M21 Chemical Agent Detector Alarm). It automatically integrates contamination information from detectors with input from onboard navigation and meteorological systems and automatically transmits digital NBC warning messages through the maneuver control system to warn follow-on forces. The M93A1P1 uparmored configuration added improved weapon and slat armor to improve crew survivability.

The Joint Biological Point Detection System (JBPDS) is the first fully automated biological threat agent detection, collection and identification suite designed for employment by all four services. JBPDS is a modular system that provides both continuous and real-time aerosol detection with presumptive identification for up to 10 agents simultaneously within 18 minutes. Upon positive identification, the user is alerted by both an audible and visual alarm. Each identified sample is safely collected and packaged for laboratory analysis. Both remote and local monitoring is available.

The modular design of the JBPDS provides not only an open architecture for upgrade insertion, but also the capability to remain in operation even if one of the components fails.

The JBPDS is available in four different configurations (portable, shelter, shipboard and trailer) to provide a common detection and identification capability for joint interoperability and supportability. JBPDS integrated platforms include BIDS, Stryker reconnaissance vehicle (RV), Surface ship and Joint Service Lightweight NBC Reconnaissance System. JBPDS also supports homeland defense operations.

The M31E2 JBPDS-BIDS is an Army variant composed of an S788 lightweight multipurpose shelter mounted on a dedicated vehicle M1097 or M1113 Humvee with digital communication (FBCB2) and an onboard generator. It is a corps-level asset employed by a dedicated biological defense company to detect large-area biological attacks. The BIDS network provides the basis for warning and confirming that a biological attack has occurred.

Individual NBC Protection
The M40/42-Series Protective Masks, a family of chemical-biological (CB) protective masks, provide respiratory, eye and face protection against chemical and biological agents, toxins, radioactive particles and battlefield contaminants. The M40/42 series replaces the M17, M25 and M9 masks. Features include an improved face seal for better protection and vision, flexibility at temperature extremes, increased useful life, weather and ozone resistance, improved soldier comfort, and ease of cleaning and maintenance.

M40/42-series masks are issued to soldiers, sailors and marines—the M42A2 to armored crews and the M40A1 to the balance of the force and U.S. Army Materiel Command surety sites.

The M40A1 and M42A2 masks have a silicone rubber face piece with an incarcerated peripheral face seal and binoocular rigid-lens system. The basic mask, the M40A1, includes a face-mounted canister with NATO standard threads (gas and aerosol filter) that can be worn either on the left or right side; a drinking tube; and clear and tinted lens “outserts.” When the canister is attached to a connection hose and equipped with a canister carrier, larger mask carrier and detachable microphone, the mask becomes the M42A2, which is used by all combat-vehicle crew personnel. The interchangeability also allows the repair of masks using a face piece assembly while retaining other existing, undamaged parts instead of a total replacement. This advance saves significant money and time.

The M45 Chemical-Biological Protective Mask replaces the M24 and M49 mask systems. The M45 mask supports the Land Warrior program, as well as Joint Special Operations Command requirements, and serves as the mask for Army, Navy, Air Force and Marine Corps personnel who cannot be fitted with the standard M40/M40A1, M42/M42A2 or MCU-2A/P protective masks.

The M45 mask provides protection to the face, eyes, head, neck and respiratory tract from CB agents and radioactive particles without the aid of forced ventilation air,
while maintaining compatibility with rotary-wing aircraft-sighting systems and night-vision devices. The M45 mask consists of close-fitting eye lenses, front and side voice-mitter for face-to-face and telephone communication, a microphone pass-through for aircraft communications, a drinking tube pass-through, a low-profile canister interoperable hose assembly to allow both hose and face-mounted configurations, interchangeable nose cups, a rubber face piece with an in-turned peripheral seal, and a second skin and hood.

Protection is provided by the agent-resistant face piece and second skin and hood.

Although all three components protect the soldier against CB agents in gaseous form, the second skin and hood provide increased liquid agent protection. The Land Warrior configuration does not include the hose assembly, hood, canister baffle, microphone or microphone cable.

The mask is available in four sizes, and the interchangeable nose cups come in five different sizes to improve fit, comfort and vision. A different nose cup configuration is available for left-hand firing. Vision-correction inserts can be fitted inside the face piece.

Close-fitting eye lenses are shaped to improve peripheral vision and are compatible with most optical sighting and night-vision devices. Easy use of a drinking system permits intake of liquids.

The XM50 Joint Service General Purpose Chemical-Biological Protective Mask (JSGPM) program will provide the next-generation mask for all U.S. joint service ground forces.

The JSGPM requirements include meeting existing and new threats posed by both chemical and biological agents and selected toxic industrial materials/chemicals that American forces may face in the future.

Other key performance parameters include a focus on reduced weight and bulk (smaller logistical footprint), compatibility with current and emerging equipment, improved reliability and an overall improved mission performance for soldiers, aircrews, marines and sailors. The cradle-to-grave acquisition approach will also focus on reducing the total ownership cost for all services by replacing the five existing general-purpose protective masks with this one item.

The design goals call for significant improvement (50 percent) over the M40 in the areas of breathing resistance, weight and bulk, compatibility with current and future systems, maintenance (50 percent fewer parts), and agent and toxic industrial chemical filtration included in the filter design. Production is planned to run through FY 2015 for a U.S. acquisition objective of approximately 2.2 million masks.

The M43/M48 Chemical-Biological Aircraft Protective Mask provides CB protection for Apache aviators and was designed for compatibility with the AH-64 Apache helicopter's integrated helmet and display sighting system (IHADSS) and optical relay tube.

The M43 mask has a form-fitting butyl rubber face piece with lenses that mount close to the eyes; an integrally attached CB hood and a skull-type suspension system; an inhalation air distribution system for regulating the flow of air to the oronasal cavity; lenses and hood; and a pressure-compensated exhalation valve assembly for maintaining overpressure in the mask and hood. The overpressure is maintained by a portable blower/filter system that operates on battery or aircraft power and filters air through a pair of C2 canisters.

The M43-type I mask has a notched right-eye lens to allow interface with the helmet display unit of the IHADSS equipment. The mask was specifically designed for compatibility with the subsystems of the AH-64, and it provides protection for the head, face, eyes and respiratory system against field concentrations of all chemical and biological agents in liquid and aerosol forms, and against toxins and radioactive fallout particles.

Vision correction is accomplished via
contact lenses. In addition, the mask provides external voice communications and a drinking tube assembly.

M43 is type-classified limited production-urgent and is currently fielded to all Apache pilots.

The M48 mask, chemical-biological Apache aviator, is an improved M43A1-series mask (M43-type I) that is used by Apache helicopter pilots.

The M48 mask replaces the existing M43 blower with a portable lightweight motor blower (LWMB) that provides blown and filtered air for breathing, lens defogging and head cooling, thus enabling the aircrew to perform its mission in a CB environment both inside and outside the aircraft.

During flight operations, the LWMB will be mounted in the Apache cockpit in the same location as the M43 blower and can be quickly removed during an emergency egress procedure. The M48 was type-classified Standard A in 1996.

Collective Protection

The Chemical-Biological Protective Shelter (CBPS) replaces the M51 collective protection shelter. It consists of a lightweight multipurpose shelter mounted on an expanded-capacity variant Humvee and a 300-square-foot airbeam supported soft shelter.

The CBPS provides 72 hours of contamination-free, environmentally controlled working area for medical, combat service and combat service support personnel to obtain relief from the need to continuously wear chemical-biological individual protective clothing. Medical equipment and crew gear are transported inside the LMS and additional medical equipment is carried on a towed high-mobility trailer.

An engineering change (EC) is being implemented to replace the hydraulic powered environmental support systems (Model 1) components and eliminate the need to use the Humvee engine. The EC will incorporate a self-powered electromechanical environmental support system (Model 2). A contract option has been exercised to procure 26 CBPS (Model 2) systems.

Chemically Protected Deployable Medical Support (CP DEPMEDS) is a containerized set that provides Army DEPMEDS combat support hospitals with a capability to sustain operations in an NBC environment.

This modular system integrates environmentally controlled collective protection elements into the hospital to reduce casualties and enhance combat effectiveness.

CP DEPMEDS uses M28 collective protection equipment, power, waste and latrine management assets to provide an extended hospital capability.

The M20A1 Simplified Collective Protection Equipment (SCPE) provides a clean-air shelter for use against chemical and biological warfare agents and radioactive particles. The SCPE is an inflatable shelter which allows personnel to perform duties without wearing individual protection equipment. It can be used as a command, control, communication and intelligence shelter or as a soldier rest-and-relief facility.

Information Systems

The Joint Warning and Reporting Network (JWARN) is based on a commercial off-the-shelf software package developed by Bruhn New Tech. JWARN hazard prediction warning and reporting procedures for NBC attacks are based on standard NATO Allied Technical Publication (ATP)-45 procedures. JWARN was designed to allow warfighters to determine and display NBC hazard areas resulting from the use of NBC weapon systems and dissemination devices. JWARN has the ability to provide hazard estimates of onset times and duration of hazard. JWARN also provides database management to store information used to warn units and can generate the standard ATP-45 message set and overlays. The program operates in exercise and operational modes.