International Journal of Instructional Cases

Army camouflage: You can't kill what you can't see

Robert (Bob) F. Mortlock, PhD, CMBA, PMP, PE
rfmortlo@nps.edu

Author:

Dr. Robert Mortlock teaches program management courses in the Graduate School of Business and Public Policy at the Naval Postgraduate School (NPS). He joined the NPS faculty after a 27-year Army career specializing in defense acquisition. Dr. Mortlock's research interests include the development of case studies, which he incorporates into MBA and Master of Science in Program Management courses. He holds a Ph.D. in chemical engineering from the University of California, Berkeley, a MBA from Webster University, a M.S. in national resource strategy from the Industrial College of the Armed Forces and a B.S. in chemical engineering from Lehigh University.

A concise case from the ***International Journal of Instructional Cases***

www.ijicases.com

International Journal of Instructional Cases

Army camouflage: You can't kill what you can't see

Current Situation, Spring 2014

Colonel Bob Smith, the Army Project Manager (PM) responsible for uniforms, felt uneasy as he prepared for meetings in the Pentagon with Army senior leaders regarding the final decision on the camouflage pattern for combat uniforms. He had been down this road for the previous two years—each time the Army delayed the decision. The Army postponed the decision on the camouflage pattern for a variety of reasons to include testing gaps, contract issues, intellectual property challenges, National Defense Authorization Act (NDAA) concerns, as well as affordability and implementation issues. Although Colonel Smith felt uneasy, he was also confident that his team had addressed all stakeholder concerns and followed the guidance provided by the senior leadership. The urgency to change the camouflage patterns on combat uniforms remained an Army top priority, and he remained committed to getting a decision.

Background

The protection of American soldiers in combat was a top priority for senior leaders in the U.S. Army. Camouflage on combat uniforms offered individual soldiers concealment on the battlefield, which contributed to increasing mission effectiveness and better protection. In Afghanistan, for example, Army soldiers faced diverse battlefield operating environments in combat operations (see Figure 1). During a single mission, soldiers faced many different terrains across various environmental backgrounds. Each of these environmental backgrounds contained different earth-tone colors, which required different matching earth-tone colors in the combat uniform to effectively conceal a soldier from detection and/or observation. Soldiers who wore combat uniforms and equipment with the universal camouflage pattern (UCP), a three-color digital pattern adopted by the Army in 2005, did not effectively blend into the diverse backgrounds typical during combat missions. The UCP colors were not earth-tone and were generally too bright—making soldiers easy to detect and providing ineffective concealment.

From 2005 after the adoption of the Army combat uniform (ACU) with UCP until 2009, the Army received overwhelmingly negative feedback from soldiers in Afghanistan about the suitability of UCP for the diverse Afghan backgrounds and environments. As a result, in the 2009 Supplemental Appropriations Act, Congress directed the Army to take action to provide effective camouflage for personnel deployed to Afghanistan. In September 2009, the Army submitted a Report to Congress on Combat Uniform Camouflage that outlined a four-phased approach: Phase I Immediate Action, Phase II Build the Science, Phase III OEF Specific Camouflage, and Phase IV Army Combat Uniform Decision for a Long-Term Multi-Environment Camouflage. (Refer to Exhibit 1 for a summary of the results of the Army's four-phased camouflage testing effort from 2005 to 2013).

International Journal of Instructional Cases

The Army recognized that advancing the science of combat uniform camouflage testing was vitally important to enabling data-driven decisions on the most effective camouflage pattern. It acknowledged that it was unaffordable to field-test various camouflage patterns in every possible environment and background. To gain a statistically robust data set to support decision-making, the Army developed a test and evaluation strategy that involved technical testing referred to as photo simulation for pattern selection and operational field-testing with soldiers for pattern performance confirmation and operational insights. (Refer to Exhibit 2 for a more detailed explanation of combat uniform testing basics.)

The Army completed Phase III and decided to give soldiers deploying to Afghanistan flame-resistant uniforms in the Operation Enduring Freedom (OEF) camouflage pattern (OEF CP). The Phase IV decision on the camouflage pattern best for the entire Army on all uniforms and equipment had much wider implications, ranging from affordability concerns to implementation challenges. (Refer to Exhibit 3 for a basic overview of Army camouflaged uniforms and equipment.) Figure 2 displays a pictorial representation of the uniforms soldiers would typically wore in the spring of 2014 at the time the Army was trying to make a camouflage decision. Soldiers wore the ACU with UCP in most regions, except in the Middle East. Soldiers wore the flame resistant ACU (or FRACU) with UCP when deployed to combat operations in Iraq and Kuwait, while soldiers supporting combat operations in OEF wore the FRACU in OEF CP.

For the long-term Phase IV effort, the Army remained committed to adopting a family of three camouflage patterns—one suited for operations in desert/arid environments, one suited for operations in woodland/jungle environments, and a transitional pattern suited for all other environments. The transitional pattern was also the camouflage on the uniforms soldiers wore in daily, non-combat, garrison operations. This decision affected not just soldiers deploying to combat operations, but all active duty, reserve duty and National Guard soldiers numbering approximating 1 million total soldiers.

Twice the Army made a decision on this transitional camouflage pattern change away from UCP, and both times issues arose that stopped the implementation. In the spring of 2013, the Army's decision to adopt a Phase IV vendor's transitional pattern was delayed due to concerns about language in the draft FY14 NDAA and contract protest risks. Subsequently, the Army changed strategies in the summer 2013, and tried to adopt OEF CP as the Army's transitional pattern on uniforms across the Army. However, contract negotiations with Crye Precision LLC, the vendor that owned the rights to OEF CP, commercially known as MultiCam©, stalled over affordability concerns. Crye offered OEF CP to the Army for a lump sum payment of $24M or a 1% royalty on all camouflaged uniforms and equipment.

Army Guidance, Winter 2013

In December 2013, the President signed into law the FY14 NDAA. As anticipated from the language in the early draft versions, the FY14 NDAA severely restricted the number of camouflage patterns across the Armed Services. The Army, Navy, Air Force and Marine Corps could keep their current camouflage patterns, but, going forward, they were limited to existing

International Journal of Instructional Cases

camouflage patterns unless all the Services agreed to change. The final NDAA made the concerns of the Army from the previous spring a reality. The Army's strategy to delay the camouflage decision was a good one.

Following a series of meetings in the Pentagon with Army senior leaders, the chief of staff of the Army issued the following guidance: delay any immediate decision, ensure all options for the Army moving forward were rigorously tested, ensure the options considered met the intent of the NDAA by meeting with the congressional professional staff members, and provide regular updates to the Secretary of the Army. The Secretary of the Army subsequently approved the testing of transitional pattern alternatives for March 2014 with an anticipated decision in April 2014 pending successful and positive testing results (see Figure 3).

Program Implementation, Spring 2014

Colonel Smith led his team to execute yet another revised strategy for combat uniform camouflage testing. The intent of the new strategy was to consider alternatives to OEF CP that provided equivalent or better performance, were affordable/fiscally responsible to implement, and were in compliance with the FY14 NDAA. The testing included three baseline reference patterns [UCP, Marine Corps pattern (MARPAT) Woodland, and MARPAT Desert], OEF CP, and viable OEF CP alternatives. These alternatives were the ScorpionW2 pattern and two digital transitional camouflage patterns (referred to as DTC1 and DTC2—patterns based on MARPAT but with four earth-tone based colors; see Figure 4). The Army had a series of meetings with congressional members who sponsored the NDAA legislation and professional staff members who wrote the actual language to ensure the patterns considered were within the intent of the law. Congressional leaders considered the DTC1 and DTC2 patterns in a "gray area" of the new restrictions and were noncommittal if these patterns met the intent of the law. Nevertheless, the Army decided to test these patterns along with the other patterns.

In April 2014, the Army tested alternative transitional patterns at Fort Benning in operational field tests with U.S. Army Sniper School cadre and in photosimulation assessments using soldiers from the 75th Ranger Regiment (testing results presented in Figures 5 and 6). The testing to support an Army decision was rigorous and met the intent of the Army Chief of Staff. The testing involved sniper experts to assess the operational relevance of the patterns in field tests and 106 soldiers as observers of the patterns in 46 separate backgrounds in photo simulation evaluations—collecting 19,474 data points.

From the results shown in Figures 5 and 6, the Army came to the following conclusions: UCP performed poorly in all backgrounds (confirming prior results); OEF CP, ScorpionW2, DTC1, and DTC2 scored similarly across all background types; MARPAT woodland performed well in woodland dormant backgrounds; and MARPAT desert performed well in arid environments. The results confirmed that there was a "tight shot" group for the effectiveness and performance of the transitional patterns. The Army decision criteria would come down to other considerations like affordability/cost, implementation and execution ease, schedule, contracting challenges, and intellectual property rights concerns (potential patent, trademark, and copyright challenges).

International Journal of Instructional Cases

Colonel Smith assembled his team to consider the following options for Chief of Staff and Secretary of the Army to consider:

- Option 1: Do nothing. Make no decision at this time and continue the current situation of issuing Soldiers UCP uniforms and equipment for all missions, except in Afghanistan where they would continue to get OEF CP uniforms and equipment.
- Option 2: Select OEF CP, accept the vendor's terms, and expand its use beyond Afghanistan to being the standard pattern of all Army uniforms and equipment.
- Option 3: Select ScorpionW2 and replace UCP uniforms and equipment over time when they wore out.
- Option 4: Select a digital transitional camouflage (DTC1 or DTC2) and replace UCP uniforms and equipment over time when they wore out.

His team considered these options the main courses of action for Army senior leaders to consider. The team debated the following decision criteria to apply to these options: performance, schedule, affordability/cost, legal risk, and the perspectives of key stakeholders such as soldiers, Congress, the Marine Corps, and the media.

As Colonel Smith prepared for the decision meetings, he did not relish the thought of going back into the lion's den again with Army senior leaders in the Pentagon. This would be the third time he attempted to get a decision on camouflage for Army uniforms and equipment. However, he knew that the decision was of utmost importance for soldiers in combat. Effective camouflage increased soldier combat effectiveness and improved force protection—saving soldiers' lives in battle. Colonel Smith thought about the decision in terms of return of investment (ROI). From 2009 to 2014 (over six years), the Army spent slightly less than $10 million in the research, development, and testing of camouflage patterns, but a camouflage change would affect the purchase of $5.2 billion of uniforms and equipment over the next 5–10 years. Colonel Smith considered the research, development, and testing of camouflage patterns a wise investment for soldiers and for the American taxpayer.

The key stakeholders knew the challenges or barriers to a decision. Despite the importance of combat uniform camouflage, efforts to change camouflage faced the challenges that all programs face: a complex, bureaucratic defense acquisition institution (refer to Exhibit 4 for a description of the defense acquisition institution). Any decision to change Army camouflage crossed multiple chains of command with different decision-makers because it affected both uniforms and equipment. The Chief of Staff of the Army approved uniform changes after an approval recommendation from the Army Uniform Board. But each piece of camouflaged equipment (e.g., cold weather clothing, rucksacks, ballistic vests, helmet covers) had a different program decision-maker—either a program executive officer or the Army Acquisition Executive. Colonel Smith labored over how to pull together this information into a decision and what recommendation he would make when invariably asked by Army senior leaders for a specific recommendation.

Colonel Smith and his team pondered the answers to the following questions:

International Journal of Instructional Cases

- Was the revised strategy executed in accordance with Army guidance and could the Army make an informed decision?
- Were the options considered the only options or were there other viable options?
- How did the results of the testing affect the Army decision?
- How did the source of funding (contingency funds or base budget funds) affect the decision for the Army?
- What were the affordability considerations for the Army in this decision?
- What were the important contractual and legal considerations in this decision?
- How should the Army compare the options and select the best path forward?

International Journal of Instructional Cases

References

Hepfinger, L., Stewardson, C., Rock, K., Kramer, F. M., McIntosh, S., Patterson, J., Isherwood, K., Lesher, L., Rogers, G., & Nguyen, H. (2010). *Soldier camouflage for Operation Enduring Freedom (OEF): Pattern-in-picture (PIP) technique for Expedient Human-in-the-Loop Camouflage Assessment*. Technical paper presented at the 27th Army Science Conference.

Lacey, D., Rogers, G. (2014, June). *Addendum to the Final Report for the Phase IV Camouflage Pattern Testing, Stage II Pattern Testing for the Army Combat Uniform (Transitional Alternatives)*. U.S. Army Aberdeen Test Center Report No. ATC-1150 (Addendum). Aberdeen Proving Ground, MD.

Mazz, J., Rowe, P. (2013, July). *Data Analysis for the Army Camouflage Uniform Improvement Project: Phase IV, Stage 2.* U.S. Army Materiel Systems Analysis Activity Technical Report No. TR-2013-39. Aberdeen Proving Ground, MD.

Mazz, J. (2014, August). *Data Analysis for the Army Camouflage Uniform Improvement Project: Phase IV, Transitional Pattern Assessment*. U.S. Army Materiel Systems Analysis Activity Technical Report No. TR-2014-39. Aberdeen Proving Ground, MD.

Mortlock, R. (2016, October–December). Transfer MDA from top-level OSD and service officials and put it where it fits best: With the PEOs. *Army AT&L*, 120–124.

Natick Contracting Division, U.S. Army Contracting Command—APG. (2012, January 9). Contract W911QY-12-C0033, awarded to Atlantic Diving Supply (ADS) Inc., Virginia Beach, VA.

Natick Contracting Division, U.S. Army Contracting Command—APG. (2012, January 9). Contract W911QY-12-C0034, awarded to Brookwood Companies Inc., New York, NY.

Natick Contracting Division, U.S. Army Contracting Command—APG. (2012, January 9). Contract W911QY-12-C0035, awarded to Crye Precision LLC, Brooklyn, NY.

Natick Contracting Division, U.S. Army Contracting Command—APG (2012, January 9). Contract W911QY-12-C0036, awarded to Kryptek LEAF, Fairbanks, AK.

Office of the Secretary of the Army. (2009, September). Department of Army report to Congress on combat uniform camouflage.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2014, July 15). *Combat uniform camouflage effort* [Memorandum]. Fort Belvoir, VA.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2013, April 11). *Army camouflage decision brief* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

International Journal of Instructional Cases

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2013, April 16). *Army clothing update for SECARMY* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2013, August 11). *Army phase IV camouflage update to SECARMY* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2013, December 19). *Army phase IV camouflage update to the CSA* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2014, January 29). *Army phase IV camouflage update to SECARMY* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

Program Manager Soldier Protection and Individual Equipment, Program Executive Office Soldier. (2014, May 2). *Combat uniform camouflage update and decision brief* [PowerPoint presentation]. Briefing prepared for Army Senior Leadership. Washington, DC.

Rogers, G., et al. (2013, September). *Final Report for Phase IV Camouflage Stage II Pattern Testing for Army Combat Uniform*. U.S. Army Aberdeen Test Center Report No. ATC-11250, Aberdeen Proving Ground, MD.

Ryerson, C. C. et al. (2012, September). U.S. European Command (EUCOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-12-1).

Ryerson, C. C., et al. (2013, August). U.S. Pacific Command (PACOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-13-1).

Ryerson, C. C., et al. (2013, September). U.S. Northern Command (NORTHCOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-13-2).

Ryerson, C. C., et al. (2013, September). U.S. Central Command (CENTCOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-13-3).

Ryerson, C. C., et al. (2013, September). U.S. Africa Command (AFRICOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-13-4).

Ryerson, C. C., et al. (2013, October). U.S. Southern Command (SOUTHCOM) natural backgrounds and U.S. analogs (ERDC/CRREL M-13-5).

U.S. Army, Natick Soldier Research, Development, and Engineering Center. (2004, December 15). *Universal camouflage for the future force warrior* [PowerPoint presentation].

International Journal of Instructional Cases

Briefing prepared for International Soldier Conference and Exhibition. Natick, MA: Author.

U.S. Army, Natick Soldier Research, Development, and Engineering Center. (2012). *Science supporting camouflage* (Draft Technical Report, Natick/TR-12/022L). Natick, MA: Author.

U.S. Army, Natick Soldier Research, Development, and Engineering Center. (2009, June). *Photosimulation camouflage detection test* (Technical Report, Natick/TR-09/021L). Natick, MA: Author.

U.S. Army, Natick Soldier Research, Development, and Engineering Center. (2005, April). *Development process of the universal camouflage for the future force warrior* (Technical Report, Natick/TR-05/014L). Natick, MA: Author.

U.S. Congress. (2013, December). *Revised policy on ground combat and camouflage utility uniforms.* In Fiscal Year 2014 National Defense Authorization Act (NDAA), Section 352, pp. 161–165.

U.S. House of Representatives. (2009, May). Making supplemental appropriations for the fiscal year ending September 30, 2009, and for other purposes (House Report 111-151).

International Journal of Instructional Cases

Appendix 1. Case Study Figures

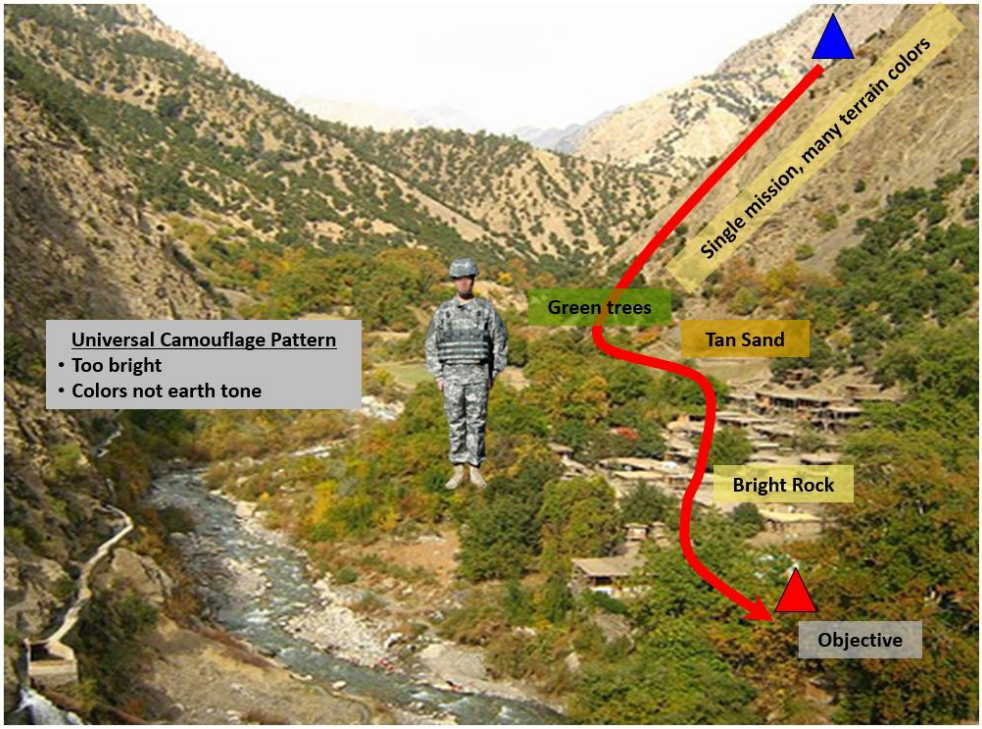


Figure 1. Diverse Battlefield Operating Environments

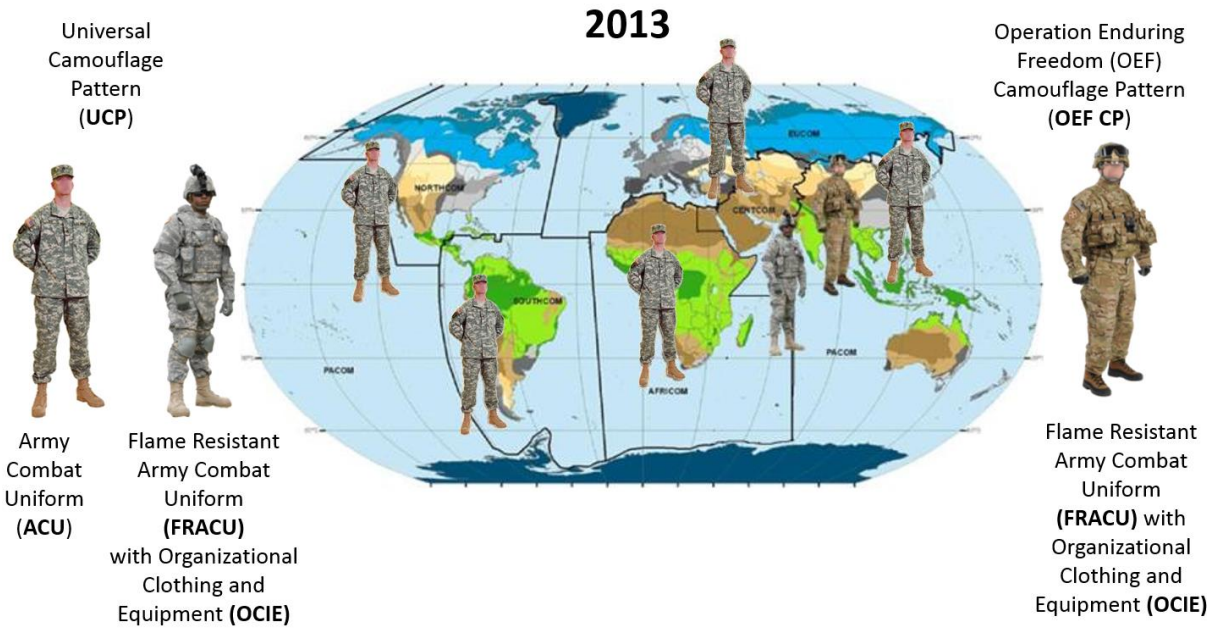


Figure 2. Common Operation Picture for Army Combat Uniforms

International Journal of Instructional Cases

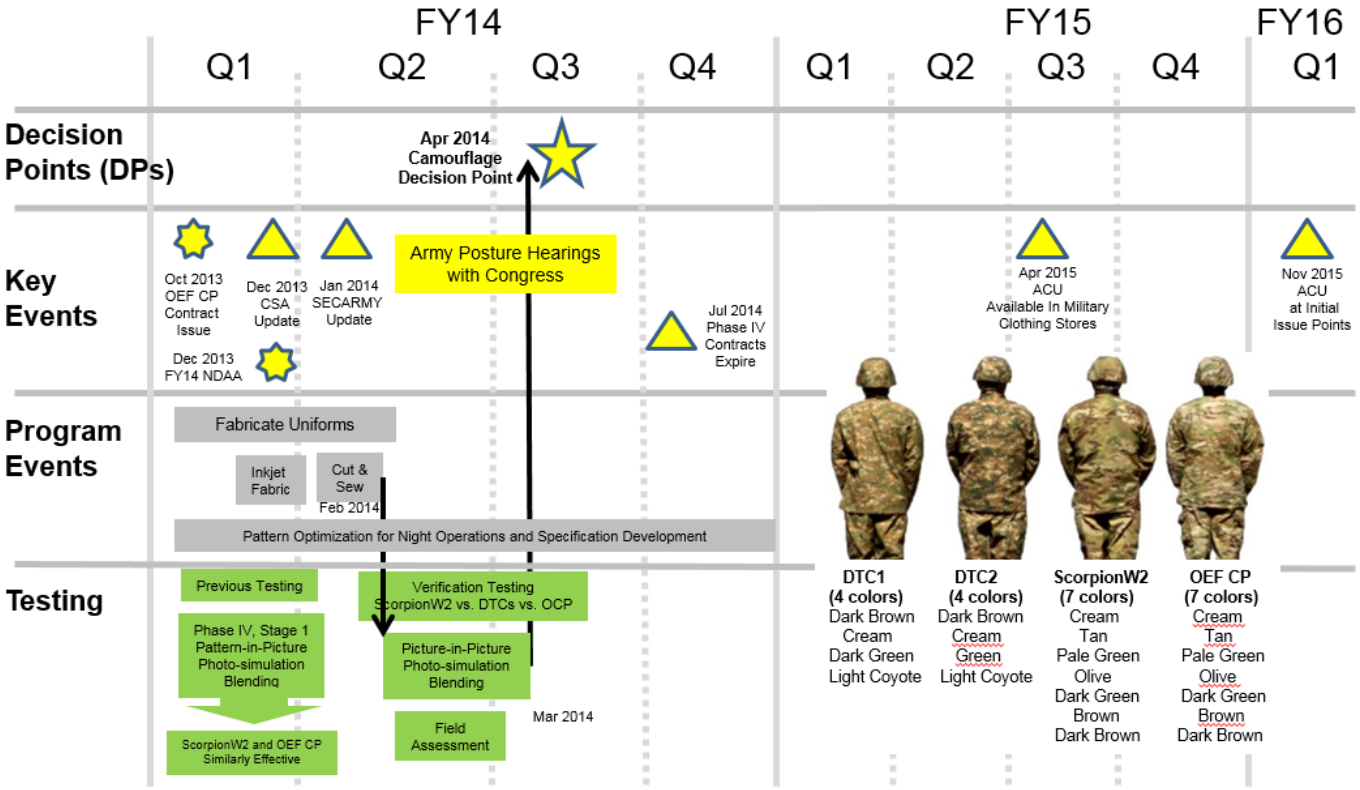


Figure 3. Approved Army Plan

Figure 4. Patterns Tested by the Army at Fort Benning in April 2014.

International Journal of Instructional Cases

Assessment Summary:

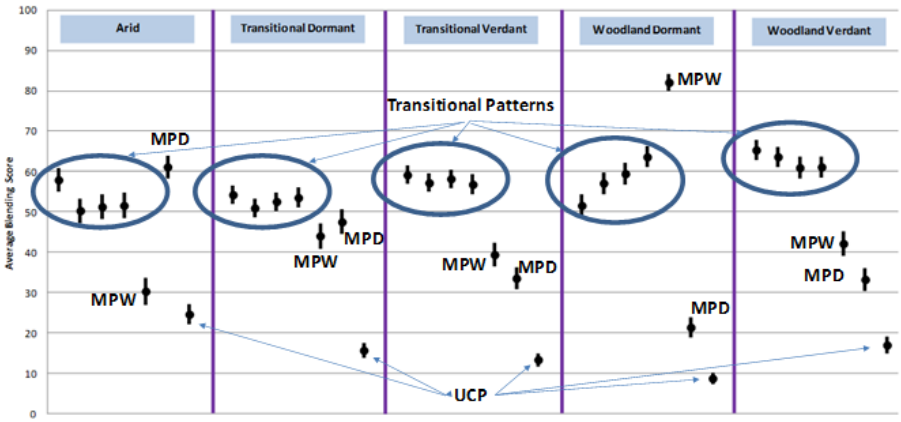
- 7 patterns, US Army Sniper School cadre, 2 locations at Ft. Benning, GA on 18 March 2014
- Mostly dormant wooded and transitional terrains out to 695m
- Sensors included unaided eye and 10x binoculars – daytime visual only

Observer Key Findings:

- After 300m all the transitional patterns appeared the same with the naked eye. With binoculars, they were able to identify DTC2. This is mostly due to the color contrast in the pattern
- DTC1, ScorpionW2 and OEFCP were said to be very similar; differences were difficult to detect
- With binoculars, OEFCP, Scorpion and DTC 1 rated higher than Woodland MARPAT and DTC2 at most stationary locations

MARPAT Woodland (MPW)	MARPAT Desert (MPD)	UCP	DTC2	DTC1	ScorpionW2 (SCORP)	OEFCP
Performance was highly dependent on immediate background	Too bright throughout the assessment	Too bright throughout the assessment	High internal color contrast was evident more than others	Performance was similar to OEF CP and ScorpionW2	Performance was similar to OEF CP and DTC1	Performance was similar to DTC1 and ScorpionW2

Figure 5. Operational Field Test Results



Assessment Summary:

- Purpose: assess from a blending perspective the OEFCP, ScorpionW2 and DTC transitional uniform camouflage pattern candidates
- 7 patterns were assessed by 106 Soldiers from 3/75th Ranger Battalion Headquarters, Fort Benning 30 March -2 April 2014
- Pictures of Uniformed Individuals placed into 46 backgrounds; each photo viewed at least 57 times
- Total data points = 19,474

Conclusions:

- UCP performed poorly in all five backgrounds
- OEFCP, ScorpionW2, DTC1 and DTC2 scored similarly across all five backgrounds
- USMC MARPAT Woodland performed well in the Woodland dormant backgrounds.
- USMC MARPAT Desert performed well in arid backgrounds

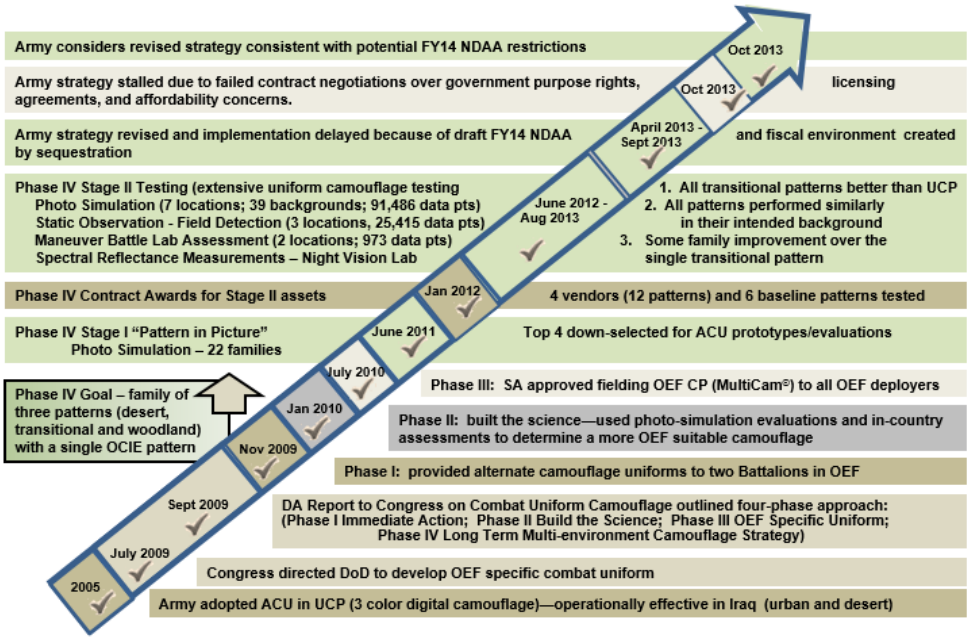
Figure 6. Photo Simulation Test Results

International Journal of Instructional Cases

Exhibit 1. Recent History of Army Combat Camouflage Uniforms

Figure 7 presents a brief recent history of Army combat uniforms since the adoption of the Army Combat Uniform (ACU) with the Universal Camouflage Pattern (UCP). In 2005, the Army adopted the ACU to replace the Battle Dress Uniform with the woodland camouflage pattern and Desert Camouflage Uniform with the desert camouflage pattern. The ACU was produced with the UCP—a three-color (urban gray, desert sand, and foliage green) digital pattern. The Army wanted a single combat uniform design with a single camouflage pattern. The Army's decision to adopt a digital pattern (UCP) was influenced by the success of the U.S. Marine Corps digital patterns—MARPAT Woodland and MARPAT Desert. Ultimately, in testing, UCP provided better or equal concealment than other patterns in urban and desert terrains—obviously very important to the Army embroiled in combat operations in Iraq.

Figure 7. Army



Camouflage Uniform Timeline

In the 2009 Supplemental Appropriations Act, Congress directed the Army to take immediate action to provide effective camouflage for personnel deployed to Afghanistan. In September 2009, the Army submitted a Report to Congress on Combat Uniform Camouflage that outlined a four-phased approach: Phase I Immediate Action, Phase II Build the Science, Phase III OEF Specific Camouflage, and Phase IV Army Combat Uniform Decision for a Long Term Multi-Environment Camouflage.

In November 2009, the Army completed Phase I by fielding two Army battalions (approximately 2,000 soldiers) with uniforms in two different patterns. One camouflage pattern was Universal Camouflage Pattern-D (UCP-D)—a variant of UCP with coyote brown color added and less sand color. The other pattern was a commercial camouflage called MultiCam© produced by Crye Precision LLC. MultiCam©—a seven-color pattern in use at the time with U.S.

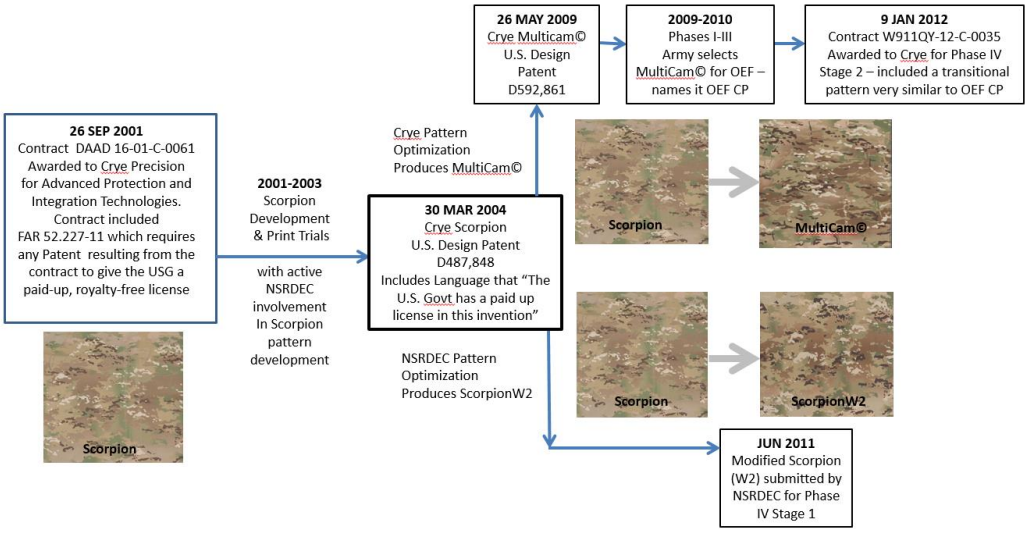
International Journal of Instructional Cases

Special Forces in Afghanistan—was a variation of the original Scorpion pattern considered by the Army earlier in the UCP decision.

In February 2010, initiating Phase III, the Army selected MultiCam© as the pattern to be used on the Fire Resistant ACU (FRACU) and Organization Clothing and Individual Equipment (OCIE) for deploying Soldiers to Afghanistan. The Army named the commercially available MultiCam© pattern as the Operation Enduring Freedom (OEF) Camouflage Pattern (OEF CP). Due to private licensing agreements that resulted in licensing fees embedded in uniform costs, the Army paid about a 10% premium on every OEF CP camouflaged uniform or piece of equipment compared to UCP uniforms and equipment.

In December 2010, the Army outlined an 18-month Phase IV effort for the Army's selection of camouflage to be effective in desert/arid, transitional, and woodland/jungle environments. The objective of Phase IV was to develop a "family" of three uniform camouflage patterns with a single coordinated pattern for OCIE to provide effective concealment in woodland/jungle, transitional, and desert/arid environments. Five families of patterns (four commercial vendors and one government submission by the Natick Research, Development & Engineering Center) performed as well as or better than the legacy family of patterns. The four down-selected vendors included Crye Precision LLC, Kryptek Inc., Atlantic Diving Supply (ADS) Inc., and Brookwood Companies Inc. It is noteworthy that three patterns were visually similar in appearance: OEF CP (a baseline pattern), the transitional pattern proposed by Crye, and the transitional pattern submitted by NSRDEC named ScorpionW2. Each of these patterns was developed, changed, and optimized independently from the same base pattern called Scorpion—a pattern developed by Crye in the early 2000s under contract with the U.S. Army (see Figure 8 for a description of the relationships and differences between the Scorpion, MultiCam© (OEF CP), Phase IV Crye transitional, and ScorpionW2 camouflage patterns). All three patterns performed similarly in testing which served as a built-in, internal verification of the validity of the testing.

Figure 8.



Timeline of Scorpion Pattern Derivatives

International Journal of Instructional Cases

In January 2012, the Army awarded Phase IV contracts to the four down-selected vendors. The contracts included contract options to procure the non-exclusive license rights for each of the proposed camouflage patterns. The competitive range to buy the license rights from the four vendors for a single camouflage pattern ranged from $25,000 to $2.1 million. Crye offered the set of patterns for $600,000 ($200,000 each for three patterns—woodland, desert, and transitional/OCIE). Each vendor signed a non-exclusive license agreement which provided the Army the option to obtain (for a single lump sum) the rights to use the material for the production of patterns for printing on an unlimited number of uniforms, individual equipment, and unit level equipment for U.S. government purposes (e.g., Army, Navy, Marine Corps, Air Force, and Coast Guard, including their active and reserve components) excepting foreign military sales with successive renewable 10-year periods.

From July 2012 to March 2013, the Army conducted extensive uniform camouflage testing. The 12 commercial vendors' patterns (each of the four vendors had a woodland, transitional, and desert pattern along with a matching transitional OCIE pattern) and six reference patterns (UCP, OEF CP, MARPAT-W, MARPAT-D, and Navy patterns) were printed on fabric, and the fabric was assembled into uniforms and OCIE. The results of this extensive testing showed that all the vendor patterns in their intended backgrounds performed better than UCP—confirming the Army's intent to replace UCP. All the vendors patterns performed similarly in their intended backgrounds—this "tight shot" group gave the Army many options and confirmed that overall pattern colors and brightness was much more important than pattern design when assessment concealment effectiveness.

In May 2013, Army senior leaders approved the expanded use of OEF CP to replace UCP across the Army and the purchase of the non-exclusive government license rights to one of the competing vendors' patterns (the Crye transitional pattern that was very similar and visually indistinguishable from OEF CP) offered as an option in the Phase IV contract. Because all of the vendor patterns performed similarly in testing, the Army based its decision on other considerations, primarily affordability—the Army could leverage existing inventories of OEF CP OCIE and reduce the overall implementation costs to the Army. However, the Army delayed the announcement of the decision. Army senior leaders were hesitant to announce a uniform change decision during a time of intense budget pressure and with the threat of sequestration looming. More importantly, Congress released the draft fiscal year (FY) 2014 National Defense Authorization Act (NDAA), and it potentially limited the Army's camouflage flexibility by prohibiting any new camouflage patterns unless all services adopted the new pattern. At the time, it was unclear whether the camouflage patterns tested in the Phase IV effort would violate the NDAA restrictions.

In August 2013, to avoid the threat of protests by Phase IV vendors and subsequent lengthy contractual challenges and to avoid potential violations of the new statutory restrictions in the pending NDAA, the Army changed its contracting strategy to pursue a sole-source contract for the non-exclusive license rights (i.e., government purpose rights) to OEF CP and to delay exercising any remaining Phase IV contract options until the FY14 NDAA language was final. The vendor, Crye Precision LLC, indicated to the Army that the price for OEF CP would

International Journal of Instructional Cases

be similar to the price offered to the Army for the transitional pattern non-exclusive license rights in the Phase IV contract.

In October 2013, Crye Precision LLC balked at the terms of the contract proposed by the Army for OEF CP. The contract terms for the non-exclusive license rights were identical to the Phase IV contract option terms. Crye Precision LLC wanted considerably more money for OEF CP than offered for its transitional pattern, forcing the Army to consider alternatives.

International Journal of Instructional Cases

Exhibit 2. Camouflage Testing Basics

Two different criteria existed to compare the effectiveness of camouflage: detection and blending. Camouflage testing determined detection and blending scores for various camouflage patterns in relevant military operating environments. Detection is the ability to pick out the camouflage pattern measured at different distances, and blending is how well the camouflage pattern matches the background once detected at a specific range. Photo simulation evaluations allowed for collection of significant data in many backgrounds and controlled variables (such as distance, movement, background, and brightness) so the difference in detection and blending scores could be attributable to different camouflage patterns. The word "simulation" referred to the fact that the technique simulated Soldiers being outside at the various sites by looking at computers screens of photos of Soldiers in camouflage uniforms. Camouflage pattern selection criteria was based on both detection scores (at ranges to 450 meters during the day and to 250 meters at night) and blending scores (at 50 meters during the day and at 25 meters during the night). (Refer to Figure 9.)

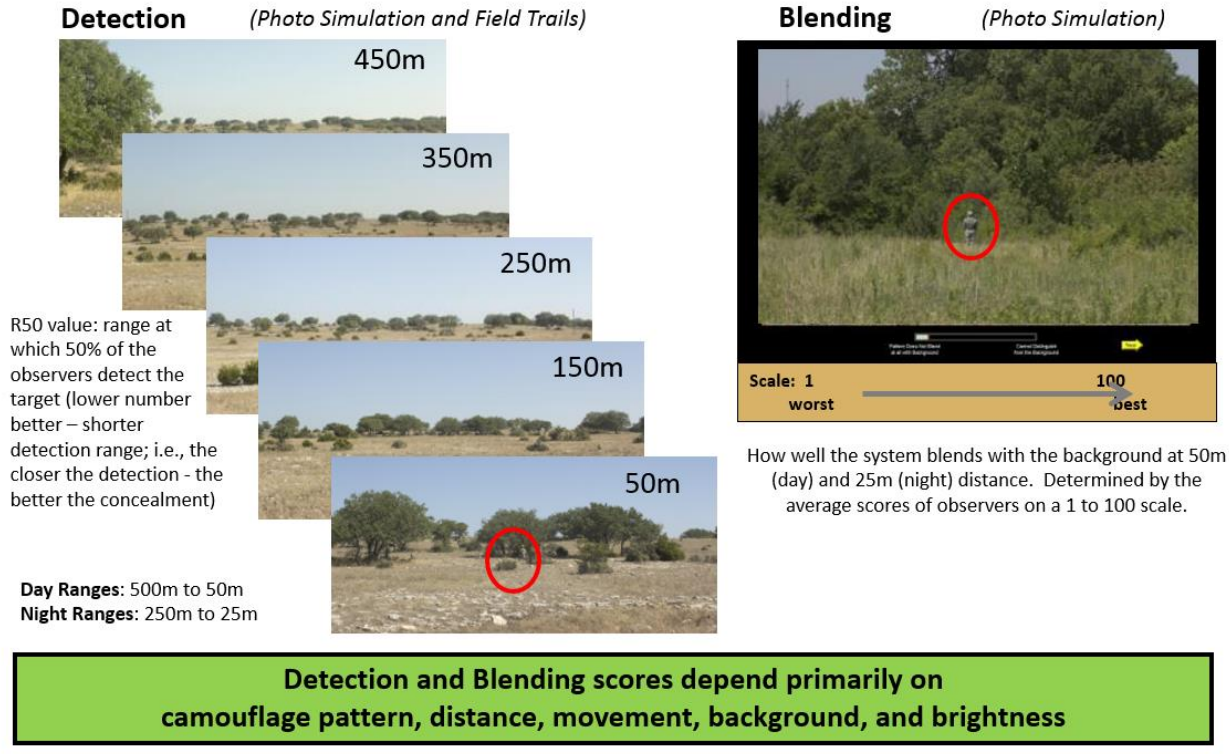


Figure 9. Camouflage Pattern Testing Criteria

Camouflage pattern testing used a combination of field trials and photo simulation evaluations. The field trials included day and night testing, and individual soldier detection/acquisition at varying distances and varying soldier positions (prone, kneeling, and standing). The soldier photo simulation evaluations included feedback from soldiers who assessed the camouflage's detection and blending ability using calibrated images of uniformed

International Journal of Instructional Cases

individuals in various backgrounds. Photo simulation evaluations allow for collection of significant data in many backgrounds.

International Journal of Instructional Cases

Exhibit 3. A Basic Overview of Army Combat Camouflage Uniforms

After basic initial entry training, the Army issued soldiers uniforms and other essential combat equipment, classified as organization clothing and individual equipment (OCIE) and generally referred to as the soldier's clothing bag. Part of this issue to soldiers was the Army combat uniform (ACU). The ACU was the uniform that soldiers wore in daily garrison operations when not deployed to combat operations. The ACU fabric was a 50-50 mix of cotton and nylon, and came with the universal camouflage pattern (UCP), selling in the Military Clothing Store for about $90 for a coat and trouser set. After they wore out, soldiers used their clothing replacement allowance to buy new sets of uniforms. Examples of OCIE included the seven-layer Generation III Extended Cold Weather Clothing System (ECWCS), the field pack or rucksack (part of the modular lightweight load-carrying equipment [MOLLE]), and the ballistic vests (part of the improved outer tactical vests [IOTV])—all issued with the UCP.

Beginning in mid-2005, the Army recognized the importance of protecting soldiers from battlefield hazards and included specific uniform requirements for protection against insects (resulting in permethrin treatment) and fire or flame (resulting in flame-resistant fabrics). When Soldiers deployed to combat, the Army issued soldiers the Flame Resistant Army Combat Uniform (FRACU) with the UCP. The FRACU was made of 65% rayon, 25% para-aramid, and 10% nylon. The price of a FRACU set of coat and trousers averaged about $180. Additionally, Soldiers received the Flame Resistant Environment Ensemble (FREE)—the FR version of the ECWCS. Soldiers did not normally deploy with the clothing bag-issued ACU and ECWCS—those were for daily wear in garrison operations and in training. In 2011, the Army issued soldiers deploying to Afghanistan for Operation Enduring Freedom (OEF) the FRACUs and OCIE with the OEF Camouflage Pattern (OEF CP).

The Army remained very cognizant of the value of the combat uniforms and OCIE worn by Soldiers and in the inventory. For example, based on the number of active, reserve, and National Guard soldiers both non-deployed and deployed, the ACUs worn by Soldiers in their clothing bag valued about $131 million and turned over every year. The value of OCIE worn by soldiers or in inventory with UCP totaled about $3.5 billion and turned over every 5–10 years depending on the durability of the items. Deploying soldiers to Iraq and Kuwait had another $170 million worth of UCP uniforms and OCIE. Uniforms and OCIE with the UCP totaled over $3.8 billion in value (see Figure 10). To support soldiers deploying to Afghanistan, the Army maintained uniforms and OCIE with the OEF CP with a value of about $1.4 billion. Based on the average monthly demand, the Army spent approximately $39 million per month sustaining UCP uniforms and OCIE from the Army base operations and maintenance budget for an Army of approximately one million Soldiers (active, guard, and reserve components).

International Journal of Instructional Cases

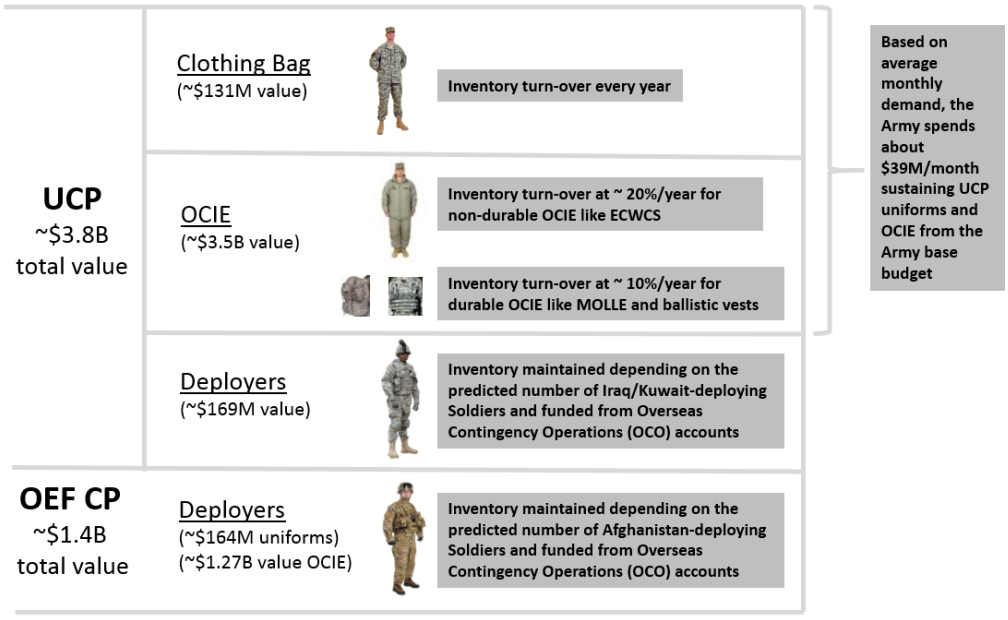


Figure 10. The Value of Camouflaged Army Combat Uniforms and Equipment

International Journal of Instructional Cases

Exhibit 4. U.S. Defense Acquisition Institution—Decision Framework

Within the DOD, the development, testing, procurement, and fielding of capability for the warfighter operates within a decision-making framework that is complex. Within the private sector, similar frameworks exist. The U.S. defense acquisition institution has three fundamental support templates that provide requirements, funding, and management constraints. The executive branch, Congress, and industry work together to deliver capability with the program manager (PM) as the central person responsible for cost, schedule, and performance. Figure 11 depicts this framework.

Figure 11. Defense Acquisition Institution

The government PM is at the center of defense acquisition, which aims to deliver warfighter capability. The PM is responsible for cost, schedule, and performance (commonly referred to as the "triple constraint") of assigned projects—usually combat systems within the DOD. The executive branch of government provides the PM a formal chain of command in the DOD. The PM typically reports directly to a program executive officer, who reports to the service acquisition executive (an assistant secretary for that service—either Army, Navy, or Air Force), who reports to the defense acquisition executive (the Under Secretary of Defense for Acquisition, Technology, and Logistics). Depending on the program's visibility, importance, and/or funding levels, the program decision authority is assigned to the appropriate level of the chain of command.

International Journal of Instructional Cases

Programs within defense acquisition require resources (for funding) and contracts (for execution of work) with industry. Congress provides the resources for the defense programs through the annual enactment of the Defense Authorization and Appropriation Acts, which become law and statutory requirements. The PM, through warranted contracting officers governed by the Federal Acquisition Regulation, enters contracts with private companies within the defense industry. Other important stakeholders include actual warfighters, the American public, the media, and functional experts (like engineers, testers, logisticians, cost estimators, etc.), as well as fiscal and regulatory lawyers.

As a backdrop to this complicated organizational structure for defense PMs, there are three decision support templates: one for the generation of requirements, a second for the management of program milestones and, and a third for the allocation of resources. Each of these decision support systems is fundamentally driven by different and often contradictory factors. The requirement generation system is driven primarily by a combination of capability needs and an adaptive, evolving threat. The resource allocation system is calendar-driven by Congress writing an appropriation bill—providing control of funding to the Congress and transparency to the American public and media for taxpayer money. The defense acquisition management system is event-driven by milestones based on commercial industry best practices of knowledge points and off-ramps supported by the design, development, and testing of the systems as technology matures.