Designing the Future Scout/Cavalry System

Will It Be a Scout or Cavalry Vehicle? Can You Have Both?

by Major Todd Tolson

Scouts and cavalry are the commander's principal reconnaissance and security assets. But since the cavalry's horses were retired, the U.S. cavalry has never had a dedicated mechanized vehicle for reconnaissance. Rather, the force has always had to improvise.

Borrowed Equipment

Early experimentation with armored scout cars was eventually abandoned in WWII, and scouts were mounted in jeeps and other wheeled vehicles instead. A dedicated scout vehicle was developed in the 1960s, with the fielding of the M114, but it was underpowered, mechanically unreliable, deficient in firepower, and was eventually retired.

More recent developments, like the XM808 Armored Reconnaissance Scout Vehicle (ARSV) in the '70s, and the cavalry regiments' M8 Armored Gun System (AGS) in the early '90s, were both canceled.

In 1994, the Army stated that the present improvised scout vehicles were inadequate to acquire threat information and will be overmatched by the projected threat by 2005.[1] The current M3A3 Cavalry Fighting Vehicle (CFV) is a refitted M2A3 Bradley (Infantry) Fighting Vehicle, while today's scouts are mounted in armored M1114 High Mobility Multipurpose Wheeled Vehicles (HMMWV). The employment of these substitute platforms perpetuates the history of cavalry/scout vehicle improvisation. An immediate need exists to correct this current shortfall in ground reconnaissance/counterreconnaissance for the future missions of Army XXI.

Army studies at the National Training Center have shown a high correlation between the success of the scout mission and the success of the supported task force, yet most of the DOD's intelligence gathering research has been focused on satellites, helicopters, and unmanned aerial vehicles (UAV). Environmental and technical conditions limit their capabilities during 24-hour continuous operations. We need a future scout vehicle to complement these assets, providing an around-the-clock, all-weather capability that is immediately responsive to the ground commander. The Army has made the case that the scout is absolutely essential for the ground component to gain information dominance on the 21st century battlefield.[2] However, limited budgets will cause the aerial versus ground reconnaissance debate to resurface frequently.

A Reduced Budget

With the end of the Cold War and the resulting change in the U.S. threat, the government not only altered the missions the Army was to perform, but reduced the Army's budget. In the past 15 years, the DOD procurement budget has declined by over 60%, while Army modernization investments have declined by more than 70%.[3] The Army has accepted risk in funding weapon modernization programs to focus on near-term readiness, manning, and quality of life programs.[4]

In this atmosphere, the DOD has developed new, innovative ways of leveraging resources to meet America's future security requirements. The new global environment has also led to a new way of doing business in weapons procurement. The Army has changed its internal acquisition procedures and sought external international partners to reduce the cost of obtaining quality equipment.

A Joint US/UK Program

The U.S. Army's requirement for a new scout system remained shelved for many years, but in 1996, the Armor Center at Fort Knox recognized that the United Kingdom's (UK) scout vehicle development project, called TRACER (tactical reconnaissance armored combat equipment requirement), was a program with a similar mission and delivery schedule (2005).[5] Both countries recognized the advantages of cooperation, and in 1998 signed a memorandum of understanding to design, develop, and field an armored reconnaissance system to meet the needs of both nations. This was the first time the U.S. and U.K. agreed to collaborate on a program to field a mechanized vehicle.

The international environment fostered a new way of doing business that benefits both countries. Two multinational industry teams were formed to compete for the design and production of the TRACER/FSCS. Since the objective is to obtain an advanced scout vehicle at less cost than two independent programs can achieve, resources are pooled during development, increasing the ranges of technology options available. During FSCS production, economies of scale will contain unit cost, reducing program life-cycle cost.[6]

The program expects to shorten the 15-year product cycle time to 10 years on the TRACER/FSCS program, a 33% reduction. By having an international cooperative team pooling greater sources of technology and innovation, the Army estimates a savings of 30% during development, 20% during production, and another 20% savings in life-cycle cost.[7]

At the conclusion of the 42-month concept phase, the two governments will select one concept design team in 2002 for further development and testing. The team that best blends a wide variety of component capabilities into a technological advanced system, while meeting the tactical and cost requirements of both nations, earns the contract. Production will commence in early 2005 with over 1,200 FSCS and 400 TRACERs.

Internal Acquisition Reform

Along with the agreement to co-develop the FSCS with the British, the new global environment led DOD to change its acquisition process. In the past, cost and schedule were flexible; the emphasis was on enemy "overmatch" performance. These performance requirements were relatively fixed (independent variable), while cost increased (dependent variable) to meet schedule. Performance was demanded at any and all cost.

CAIV (Cost As an Independent Variable) is the new acquisition philosophy where cost is treated as the independent variable. In this process, it may be

The M114 APC above, was another misdirected attempt at a scouting and reconnaissance vehicle. Seen here crossing a ford in tests at Fort Knox, it was less successful crossing paddy dikes in Vietnam, and was withdrawn from service.

Scout Vehicles: A History of Improvisation

Prior to WWII, the Army purchased armored scout cars, like the one above, to perform reconnaissance, but the lowly jeep became the most common scout vehicle during the conflict. Another improvised solution, below, was an M5 light tank with its turret removed and replaced with a .50 cal. machine gun on a ring and trolley mount.

Another makeshift scout vehicle was the M8 armored car, at left, seen in combat in France in 1944. Much of the Army's postwar aversion to wheeled scout vehicles may have originated when soldiers experienced the limitations of the M8, but it was never intended for scouting. Essentially, it was a 2-1/2-ton truck with an armored body and a light tank turret mounting a 37mm gun. Its advantages included being cheap and available in quantity at a time when industry struggled to build enough tracked vehicles.

necessary to trade off some elements of performance in order to meet previously established cost objectives. CAIV gives industry the flexibility to design systems that meet overall requirements at a reasonable cost. One of the most difficult problems in vehicle design is selecting components for a final system design. Models and virtual prototyping are used to isolate the performance-cost-risk "trade space" and identify the best vehicle value within constraints. CAIV provides a series of optimized vehicle options to assist in final vehicle design selection.

FSCS Design and Capability Issues

The tricky part of designing a combat vehicle is to determine what minimum performance capabilities must be included in the architecture to accomplish its missions, at a unit cost that will keep the "budget minded" happy. The problem with determining these mission capabilities for the FSCS is that the fundamental scout role of reconnaissance and reporting (stealth) conflicts with the cavalry's additional offensive and defensive (firepower) missions as an economy of force. So, to balance these opposing scout/cavalry requirements, all missions are analyzed and reduced to the task level, and the tasks are counted and then weighted by their collective use in various missions. These weighted tasks are used to establish both the essential key performance parameters (KPP) and those that can be traded off. This type of analysis provides mathematical support for establishing a few "common sense" traits (KPPs) that any FSCS vehicle would need to have incorporated. But the real issues are exposed when deciding whether the vehicle is going to favor executing scout versus cavalry operations.

The scouting philosophy is, "while conducting reconnaissance, don't be seen." If seen, don't be hit. And if hit, don't be killed. A vehicle that focuses capabilities on the first requirement of "not being seen" may accept risk in the other two areas. Yet looking at the many concept pictures of the FSCS generates visions of the cancelled Armored Gun System (AGS).

Key features of a stealthy vehicle would be quiet operation, a low profile, speed, and ease of maintainenance so it can be

sustained without assistance. The easiest method of reducing the noise level is to select wheels and a quiet gas/electric engine. While there has been promising research to reduce the clatter of tracked vehicles, including double-pin and banded track, wheels should remain quieter for some time to come.

Visually disappearing is a tough requirement, especially with advances in IR, radar, and thermal sensor technology. Currently, there are new developments with CARC paints and camouflage fabrics that will both reduce the infrared and thermal signatures of vehicles and provide protection from the missile-seekers on smart munitions. Although these measures sound promising, in a future war's "fight for information," any scout that is identified will be a priority target for destruction. A low-silhouette vehicle that can avoid detection is the key for scout survival in these future engagements.

A small, stealthy scout vehicle would be adequate if the cavalry didn't have its economy of force missions of guard, attack, delay, etc. A true scout vehicle may only require a medium caliber weapon (20-25mm) for self-defense and would use stealth to avoid engagement, but a cavalry vehicle requires a larger caliber (35-45mm) weapon to defeat enemy lightly armored vehicles. Cavalry engagements also demand increased armor protection to withstand the "counterpunch" of medium/large caliber enemy fires. "Pure" scout vehicles can accept some risk in this area, by avoiding contact/detection; a cavalry vehicle cannot.

The U.K. plans to solve this dilemma by building 30 of the vehicles with an "overwatch" weapon capability to provide deployable, mobile anti-tank firepower support for their scout vehicles. The U.S. has traditionally used tanks in this role, but with the M1's limited strategic mobility, the British concept has merit. Adding the Longbow Hellfire or the LOSAT missile to the TRACER/FSCS could meet this requirement. The U.S. is committed to a HMMWV LOSAT, but might also consider this "overwatch" FSCS design.

Aside from added weight and complexity, another problem in meeting the cavalry's weapon and armor requirements is the potential for "design creep," making the FSCS weapon suite similar to the system needed on the Future Infantry Vehicle (FIV). This could lead to the same "mission creep" problem that battalion scouts had with the CFV's firepower in the '80s, when scouts tended to become decisively engaged instead of avoiding enemy contact. The decision of how large a gun to place on the FSCS — big enough to defend itself, but not encourage engagements — will be a challenging decision.

Wheels or Tracks?

Is it even possible for a wheeled vehicle to meet the demands of an FSCS? Certainly, there are many four- and six-wheeled reconnaissance vehicles produced around the world that have performed marvelously. Clearly, wheeled vehicles are faster, weigh less, have better fuel economy, are quieter, and are easier to maintain. But tracks provide better ballistic protection and a smaller silhouette than wheeled vehicles. Tracked vehicles require higher maintenance and fuel during continuous operations, but wheeled vehicles have the disadvantage of limited mobility in restrictive terrain. The FSCS has to be smaller than the 8x8 LAV and have better protection than the Bradley M3.

Obviously, a wheeled FSCS could not travel everywhere tanks could go, but would it need to? Unrestricted mobility is less of a concern during defensive, reconnaissance, and security operations due to the ability and time (ideally) to pick appropriate routes. For offensive operations, today's mechanized forces attack on major avenues of approach while scouts traditionally travel on high-speed secondary routes or through forested (concealed) areas. Wheeled scouts can't travel in narrow, muddy gaps that have been churned up by tracks. But, if the Army's future involves fewer conventional missions and more operations other than war, is it essential to have a tracked FSCS?

For practical reasons, the FSCS may need to be tracked because as vehicle weight exceeds 20 tons, wheels become increasingly less effective, and a 20+ ton vehicle may be needed to allow space for the FSCS's future growth. Another wheeled vehicle disadvantage is that its large tires, needed for optimum trafficability, would make a wheeled FSCS much higher, limiting air deployability, would provide less internal volume for components, and would be difficult to armor effectively. Wheeled vehicle tradeoffs, like raising the vehicle silhouette, must be balanced against its noise reduction, range, and maintenance advantages in prolonged operations.

It's easier to make a wheeled vehicle swim, which would give scouts the huge advantage of not being limited to bridges during river crossings. With the latest technology in tires and drive systems, are we limiting ourselves before we consider a wheel option?

Common Platform Approaches

Designing future systems to operate from a single vehicle chassis greatly reduces logistical costs and infrastructure. The "family of vehicles" (FOV) concept is very popular overseas, with the Swiss providing an extreme example of having an entire mechanized force (tanks, infantry, scouts, mortars, artillery, maintenance, and engineers) all built on one chassis.

Having one chassis design for a wide variety of vehicles provides a major logistical advantage, but there are also limitations. The FSCS is touted as the advanced technology demonstrator for the FIV and Future Combat System (FCS). Both programs may try to put their components on the FSCS as a test bed for their own needs. As a result, the FSCS can lose its identity as a low-silhouette, stealthy vehicle. A family-of-vehicles approach would require any tracked FSCS to have a chassis compatible with personnel requirements for the Future Infantry Vehicle, the follow-on to the M2. Both the FIV and the Future Combat System programs will require a lethal offensive weapon suite for their missions, a requirement that might "creep" onto the FSCS design, adding firepower that would not be essential for the scouts' primary missions.

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It is accepted today that any future light armored force must be built around a FOV concept, to reduce cost while increasing the supportability of a variety of vehicles. But does the FSCS have to become a part of the family, or is the scouting community better served with a unique vehicle (wheeled or tracked)? By 2025, the U.S. should have a common heavy and light chassis for tanks, artillery, infantry, engineer, air defense, and maintenance vehicles. It may be a political/financial reality that a FSCS will be designated to set the light chassis FOV standard, serving as the "bridge" for the FIV/FCS programs. This raises a historical concern: that, since WWII, as previous scout/cavalry designs became closer to infantry or tanks, the programs have been cancelled. The joint venture with the U.K. may alleviate some of these con-

Blind Alleys

The ill-fated Armored Reconnaissance Scout Vehicle program of the 1970s actually produced two prototypes, one wheeled and one tracked, including the ingenious Lockheed wheeled vehicle, at right, that was hinged to perform reconnaissance in rough terrain. Three of these were built and extensively tested. At left is the tracked entry, seen here in model form.

cerns, but the Army will be challenged to keep the push for a FOV from redefining or confusing the capabilities needed on a scout vehicle.

FSCS Manning – Death Before Dismount?

There is a growing trend spawned through DOD downsizing to do more with less and let technology fill the gap, but a scout vehicle manned by only two or three soldiers would not allow scouts to conduct their traditional dismounted operations. Mounted operations are important, but one of the most lethal forces on the battlefield is the trained dismounted scout, in position, with a radio.

A fourth man should be considered so FSCS sections can conduct three- to six-man patrols, a limited capability of the current 10-HMMWV scout section which may have only six FSCS vehicles. A fourth man is also necessary for continuous surveillance and maintenance operations in a turreted and tracked FSCS vehicle. While there have been promises of reduced maintenance duties on the FSCS through "highly advanced technologies and extended reliability,"[8] the debate becomes moot when the first enemy shell falls.

FM 100-55, Reconnaissance Operations, states that "Equipment factors can drive the choice of reconnaissance techniques, however, they should not dictate that choice." It would be criminal to provide scout/cavalry units a new vehicle, but eliminate their ability to choose between mounted and dismounted operations because of inadequate manning. In designing the FSCS, we must remember that scout and cavalry units must be provided with not only the equipment, but also the personnel necessary to accomplish the missions of the future.

The FSCS's Competition — Aerial Reconnaissance

With recent technological advances in all-seeing long range battlefield sensors mounted in UAVs, helicopters, or large platforms such as Joint Surveillance Attack Radar System (JSTARS), the issue of why we need to fund a new reconnaissance program is legitimate. To win the future information war on a limited budget, the Army must decide how much to resource the competing technology demands of aerial versus ground reconnaissance systems.

Scout helicopters offer the advantage of rapid exploration of large areas, using thermal and other sensors to detect and acquire targets. UAVs offer the additional flexibility to fly deep into enemy territory to obtain timely intelligence without risking human life. However enemy ADA, weather, aviation logistical support, and the ability to locate camouflaged smaller forces limit both systems. Additionally, the responsiveness of helicopters, UAVs, and other intelligence assets to the brigade and below commander's information requirements will always be a struggle with higher headquarters. The FSCS provides the ground commander direct access to an intelligence gathering system essential for decision-making on the battlefield.

MG Roy Beauchamp, Commanding General of Tank-automotive and Armaments Command (TACOM), made the case for ground reconnaissance. He stated in April 1998 that, "a ground scout is still necessary for mounting continuous operations because: it can operate in all weather; is unaffected by air defenses; permits on-site judgment; allows physical retrieval of materials; and can complement airborne sensors by operating in areas obscured from aerial observation by terrain, foliage, or camouflage."[9] The important factor is that the FSCS' design must demonstrate unique capabilities to truly differentiate the system from the Army's other information gathering platforms.

A Solution – Modularity

The competing scout/cavalry capabilities make it hard to create one design that fits all. There are light forces pushing for a wheeled FSCS focused on stealth, while some in the heavy (cavalry) force may still desire another "bite" from the cancelled AGS "apple." Reality dictates that "we need a light armored vehicle that can operate on both ends of the spectrum of conflict — a vehicle that gives us greater (stealth) versatility while allowing us to deploy early and offer a credible (armored) deterrence."[10]

A scalable, modular design is one solution that might meet the differing needs of the U.S. and British armies for ground reconnaissance. All vehicles would be equipped with a superior C4I and sensor suite to perform standard operations. The scout-like variant could have just the basic equipment and self-defense weapons, while cavalry vehicles would have a larger caliber gun placed on the same hull. Similarly the UK "overwatch" vehicles could have their base TRACER hull augmented with the latest in anti-tank missiles. The combination of modular scout and cavalry FSCS variants would allow the Army to efficiently conduct future ground reconnaissance in conventional and non-conventional settings.

For non-confrontational settings, the U.S. could maintain the current XM1114 scout HMMWV or upgrade it to be similar to MOWAG's 5-ton armored "Eagle"

version of the HMMWV that is currently used by the Swiss and Danish militaries. This action would maintain the Army's ability to conduct humanitarian operations with the appropriate protection for ground reconnaissance forces.

FSCS Program Survival

The Armor community must make clear its role in the new global environment. The cold war Abrams and Bradley systems will be here for another 20 years, but the FSCS will be Armor's first entry into the new generation of combat systems. Concerns surround the program, and in January 1999, skeptics in the Office of the Secretary of Defense (OSD) called for a review of the FSCS, suggesting that the vehicle may cost too much and not meet the service's requirements.[11]

Cost is always a factor in designing weapon systems; the M1A2 costs over $6 million, the current Bradley M3A3 costs $3.6 million and the M1114 scout HMMWV costs $150,000. The proposed FSCS is budgeted to unit cost between $3-$5 million, but many believe an appropriate system cost should be under $2 million. OSD's concern is that the Army's FSCS proposal "specifies development of what will essentially be a medium tank, similar to the defunct AGS, as the armor community's 'bridge to the future'."[12] Some in DOD have labeled the currently envisioned FSCS a potentially "unaffordable and inappropriate concept."[13] A well-designed system, however, would spawn large international sales, effectively lowering unit cost for the U.S. and U.K.

Armor branch and the FSCS program office will continue to fight for the vehicle, but there must be care taken as to what components are mandated in the design and at what cost. In the current budgetary environment, it's not healthy to create a vehicle with the latest technology in all areas at a prohibitive cost.

Also, the mechanized community must exercise restraint and not increase the cost of the FSCS by loading it with technology that might eventually fit into their Future Infantry Vehicle and Future Combat System, but is not critical for scout and cavalry missions.

If the Armor community doesn't make the procurement of the FSCS a priority, the program will follow the tradition of the Armored Reconnaissance Scout Vehicle and Armored Gun System programs. The Infantry fought for the M2 Bradley, even though its initial performance was less than stellar. A FSCS program failure would result in the cavalry waiting on the FIV development while the scouts languish in the HMMWV. If a crisis arose which found our reconnaissance assets inadequate against the threat, would the U.S. be forced to consider the immediate purchase of a foreign scout vehicle to fill the capabilities gap, as we did with the German-built Fox chemical surveillance vehicle?

All of these concerns may be alleviated if the multinational defense industry teams and the FSCS U.S./U.K. Joint Program Office can work together on creating several vehicle concepts with necessary capabilities at a reasonable cost. Currently, the two industry teams are refining the vehicle requirements and concepts and plan to deliver competitive designs in October 1999. These designs must be robust enough to provide stealth, C4I, and protection for the FSCS while differentiating the vehicle from FIV/FCS concepts. A cooperative acquisition environment will fuel the creation of the most technologically advanced armored vehicle of the modern era.

Conclusion

The public will not tolerate the price tag for every program the Pentagon feels it needs for national security, to include; fighting two simultaneous wars, weapons development, peacekeeping and humanitarian assistance. If a cyber-terrorist, a nuclear device, or a peacekeeping operation is our most likely future threat, why do we need a modern mech force? Will DOD resource armored vehicle technology development as a priority, or will mechanized programs lose the budget fight to the Air Force, Navy, and other Army programs?

How necessary are mechanized forces in the modern era? At this moment, deterrence is being maintained in the Middle East with air and naval force. Mech forces have not been "invited" to the conflict in Kosovo. Armor is used in Bosnia and mechanized ground forces provide the military its "big stick," but at what size and strength in the future? As Armor officers, we are witnessing a reduction in force structure within our branch (from four tank companies to three in battalions). Today, where's the credible enemy mechanized threat that we can use to justify development of the Army's FSCS/FIV/FCS programs?

With the evolving Army XXI, the cutting edge of our mounted forces cannot be allowed to become "dull." The FSCS is one of the paramount systems needed to support the Army's Vision 2010 mission to "Gain information dominance." A well-designed FSCS will provide tactical and operational commanders with a ground asset that can be re-tasked on a moment's notice, that is compatible with all operations and environments and capable, through stealth, of achieving information superiority for follow-on forces. These FSCS operations will demonstrate the need for mechanized forces in the dynamic and unpredictable global environment. If the DOD does not support the FSCS, the Army will not have a modern, (C-130) deployable light-armored vehicle for at least 15 years. With the increased need for rapid deployment to meet tomorrow's threats, can the mounted force be left behind while other branches and services are left to fight and win the next war?

Notes

[1]Maggart, L., "Mission Need Statement for the Future Scout Vehicle," memo dated June 4, 1996.

[2]Sherman, J., "Future Scouts: The US and UK Join Forces to Build an Armored Future Scout Vehicle," *Armed Forces Journal International*, June 1997, p. 52.

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[4]Walker, R., "Modernizing America's Army," *Army RD&A*, 1 (1998), p. 1.

[5]Sherman, p. 50.

[6]Sherman, p. 50.

[7]Sherman, p. 52.

[8]Sharoni, A. and Bacon, L., "The Future Scout and Cavalry System," *ARMOR*, Jan-Feb 1999, p. 15.

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[11]Winograd, E., "OSD Questions Soundness of Army's FSCS," *Inside the Army*, January 25, 1999, p. 1.

[12]Ibid., p. 8.

[13]Winograd, E., "Future Scout Office Defers to Army Staff on Question of DAB Review," *Inside the Army*, Feburary 8, 1999, p. 8.

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