



Software Acquisition in the Army

Elizabeth Starrett
CROSSTALK

There has been much discussion lately regarding the Global War on Terror's (GWOT) financial ramifications to the United States Army. While all of the Department of Defense (DoD) is challenged financially during the ongoing war, the Army appears to be most effected [1, 2]. As CROSSTALK prepared this issue on Software Acquisition, we thought CROSSTALK readers would benefit from a discussion of this challenge, providing additional perspectives to acquisition efforts.

CROSSTALK contacted representative Army Program Executive Offices (PEOs) that deal with software and asked for their perspectives on several acquisition topics. We received responses from the following five PEOs (see the sidebar on page 5 for a brief description of each):

- Ammunition.
- Command, Control, and Communications-Tactical (C3T).
- Enterprise Information Services (EIS).
- Future Combat Systems Brigade Combat Team (FCS BCT).
- Ground Combat Systems (GCS).

We asked each of them the same five questions. The following are those questions and their answers:

Q: What is the biggest software acquisition challenge you are currently facing?

Ammunition: Our biggest challenge is to acquire and maintain (throughout the life cycle) safe, reliable, supportable, and modifiable systems that meet user requirements in an environment of rapid technological advances and complex regulations and policies which are, in many cases, overly broad. As an example, information assurance (IA)-related requirements are applicable equally to all systems (business, command and control, weapons in a tactical environment, etc.). However, due to the differing operational environments and system capabilities, the threats and vulnerabilities for business systems, command and control systems, and weapons systems are different, and the use of broad IA regulations and policies can create additional, and in many cases, unnecessary costs.

C3T: As the needs of our warfighters are rapidly evolving to address unique wartime challenges, the process for inserting software enhancements into Programs of Record (PORs) to satisfy these new requirements must be timely. In order to

meet urgent needs, users will sometimes develop home-grown tools and software or contract developments that may not fully consider the implications of operating in a tactical environment. Any fielded solution needs to recognize unique tactical capability demands, such as the need for efficient use of limited tactical bandwidth, interoperability with Army-provided systems, and long-term sustainment, as would be required within the normal acquisition process. Our challenge is to immediately recognize these high-priority unit needs, fully understand and document the impacts, and drive the appropriate acquisition approvals, while retaining the warfighter's confidence that the process can respond with the right solution at the right time. Anything that can be done to make the acquisition process more timely and efficient contributes greatly to mission success.

EIS: Clearly our greatest challenge is helping to take the Army Business Mission Area (BMA) into net-centric operations and warfare. This starts with Army Business Transformation and the efforts of Mike Kirby, Deputy Under Secretary of the Army Business Transformation and the Lean Six Sigma program. It makes sense to spend the time necessary to lean out our business processes before we start buying solutions. As a matter of fact, the new solutions we need to be net-centric fall into the category of enterprise solutions. These solutions are different in that they are transformational in nature and present a whole constellation of issues we have not had to deal with in the past. Enterprise Resource Planning (ERP) and Service Oriented Architecture (SOA) are two examples. Both require a massive amount of hard work in the functional community before implementation of any software can be done effectively and efficiently. A lot of hard and expensive lessons have been learned in the private sector with the use of transformational

Information Technology (IT). We do not want to miss any of these lessons as we build out the BMA. We have noted that most of the failures here have little or nothing to do with technology. The failures involve change management, governance and policy, and decision making, as well as other things we have not really dealt with before. For example, in an SOA environment, it is not about the technology as much as it is about the way you do business and how you manage the technology. This can be a monumental change for any organization, and an absolute if we are going to be net-centric.

FCS BCT: Our biggest challenge is the execution of the FCS BCT program. Technical complexity, distributed workforce, the use of commercial off-the-shelf (COTS) products, complex integration of software systems, and the long-term schedules required for ultra large software systems present a significant software acquisition challenge.

GCS: One of our biggest challenges is the synchronization of multiple sub-systems (including their support software) received from various contractors and other government agencies. The Software Blocking Initiative was supposed to ease this problem, but software synchronization remains a serious challenge.

Q: How is the GWOT affecting your organization?

Ammunition: The GWOT has produced a great urgency to quickly deliver safe, reliable, quality systems that meet users' needs. It forces a focus on continual improvement aimed at increasing system operational effectiveness while reducing overall time to field. This is not a trivial endeavor given the increasing complexity of systems and software and the complicated regulations and policies that must be adhered to.

C3T: The GWOT began as our modernization efforts, initiated as part of Force XXI, were nearing fruition. It quickly became apparent that the digital battle command software tools that were part of that initiative would become a decisive element of the fight. In a brief and historically significant period, the Army went from a small group of select units that experimented with digitization to a fully interoperable modular force operating digital command posts and related systems. For example, our Army in Iraq today operates from a *common operating picture* based on Army Battle Command System (ABCS) Version 6.4. That *common operating picture* is fed into our Command Post of the Future which allows geographically dispersed units to collaboratively visualize and plan the operational battlespace. Blue force tracking tracks and displays our platform locations in near real-time and the Joint Network Node connects our command posts using Internet Protocol-based satellite communications nodes. As the systems engineer involved with the technical challenges of integrating these C3T systems, it is hard to imagine another scenario that would have had more of an impact on how PEO C3T operates. The GWOT sharpened our focus on the task at-hand, direct support to the warfighter, while simultaneously driving groundbreaking work that transformed our tactical IT.

EIS: GWOT has refocused a great deal of resources and that means schedules slide to the right. We completely understand the constraints that everyone has to absorb with the current situation. The large enterprise systems acquisitions by their very nature are resource intensive.

FCS BCT: The GWOT serves to refine the picture of the future threat. This has highlighted the need to incrementally field capability to the current force to help prosecute the GWOT. Funding the GWOT has resulted in funding decrements to my organization.

GCS: The GWOT has had a significant impact on PEO GCS. Prior to the GWOT or Operation Iraqi Freedom (OIF), the Abrams tank program and Bradley vehicle program were downsizing (due to large funding cuts and natural attrition in personnel) in anticipation of new FCS vehicles that were on the drawing boards. Since the GWOT and OIF, billions of extra dollars have been pumped into Program Manager (PM) Heavy Brigade Combat Team to modernize these existing weapons platforms and

U.S. Army Organization Descriptions

The following organizations provided feedback to the questions submitted:

Ammunition <<http://peoammo.army.mil>>

The mission of the Ammunition PEO is to develop and procure conventional and leap-ahead munitions to increase combat power to warfighters. The PEO has been delegated as the Single Manager for Conventional Ammunition (SMCA) mission and therefore procures conventional ammunition items that have been transmitted to the SMCA for services.

Answers provided by Robin Gullifer, Program Executive Office Ammunition, Program Management; Heather Vimba, Program Executive Office, Chief Information Officer; John Scibilia Armament Research Development and Engineering Center Software Engineering Center.

Command, Control, and Communications Tactical (C3T)

<<http://peoc3t.monmouth.army.mil>>

The mission of the PEO C3T is to rapidly develop, field, and support leading edge, survivable, secure and interoperable tactical, theater and strategic command and control and communications systems through an iterative, spiral development process that results in the right systems, at the right time and at the best value to the warfighter. Today PEO C3T is involved in critical work supporting GWOT efforts through fielding situational awareness systems. These systems show a visual representation of friendly and enemy forces on computer screens inside vehicles and command posts and help to prevent fratricide or friendly fire incidents.

Answers provided by BG Nickolas G. Justice, Deputy Program Executive Officer C3T.

Enterprise Information Services (EIS) <www.eis.army.mil>

The mission of the EIS PEO is to provide joint service and Army warfighters with information dominance by developing, acquiring, integrating, deploying, and sustaining network-centric knowledge-based IT and business management systems, communications and infrastructure solutions through leveraged commercial and enterprise capabilities that support the total Army. This information dominance enables the Army to achieve victory. PEO EIS develops, acquires and deploys tactical and non-tactical IT systems and communications.

Answers provided by Dr. Chip Raymond, Director, Army Enterprise Solutions Competency Center.

Future Combat Systems Brigade Combat Team (FCS BCT) <www.army.mil/fcs>

The primary mission of the PM FCS BCT is to develop, produce and field a fully capable and sustainable FCS BCT that is compliant with the Joint Requirements Oversight Council approved Operational Requirements Document by the year 2014. A key objective of the FCS Program is to successfully develop an integrated BCT that is net-centric, lightweight, overwhelmingly lethal, rapidly deployable, self-sustaining, and survivable. The FCS-equipped BCT will be enabled by a fully integrated network that will increase connectivity and intelligence sharing within combat formations, while providing unprecedented situational awareness to soldiers in the field.

Answers provided by Edgar L. Dalrymple, PM FCS BCT, Associate Director, Software and Distributed Systems.

Ground Combat Systems (GCS) <www.peogcs.army.mil>

The mission of GCS is to maintain a total Army perspective in managing the development, acquisition, testing, systems integration, product improvement, and fielding that places the best ground combat and support systems in the hands of our soldiers. They serve as the System of Systems Integrator of the GCS for the armed forces and lead the Army transformation toward future systems as they evolve to the objective force while maintaining a current combat ready force. Their Abrams tanks, Bradley Fighting Vehicles and Paladins provide battlefield superiority in Iraq. The Stryker family, the Joint Lightweight 155mm Howitzer and Unmanned Ground Vehicles are evolving toward the Stryker and Objective Forces.

Answers provided by Mike Olsem, Senior Systems Engineer, SAIC.

enhance crew protection from enemy attacks. This has created some (temporary) acquisition and engineering staffing problems due to a shortage of experienced personnel (because of the prior downsizing/retirement of key, experienced personnel). We are coping, but

everybody is extremely busy.

Q: How are open source software and open architectures influencing your acquisition efforts?

Ammunition: In order to reduce cost and effort for compatibility, we make extensive use of COTS products in our systems. We have only just begun to look more closely at open source software and open architectures to determine how they might fit within our acquisition of systems. The mission, safety, and IA critical nature of our systems weigh heavily in determining what COTS products and open source software and architectures may be appropriate to incorporate.

C3T: The fundamental concepts behind open source software and open architectures have driven our Battle Command software technical vision and associated acquisition efforts. As depicted in Figure 1, our original acquisition efforts focused on satisfying the critical subset of requirements for high intensity conflict. Building on this foundation, we opened up our architecture by implementing a common set of COTS/government off-the-shelf services across our tactical operation centers (Point 1 on the figure represents the Battle Command Common Services [BCSS] platform for distributing services to Battle Command users). We extended this service implementation by incorporating a community contribution model for the development of Web capabilities (Point 3 on the figure represents our Information Management [IM] Framework). By incorporating the open source model and an open architecture as depicted in the figure, we have improved our acquisition process by delivering warfighter-required capabilities and partnering with

the user community in order to support requirements for full spectrum operations.

The important part of our IM Framework is that the applications and Web parts can then be managed and distributed to the community, letting the soldiers get back to doing their jobs and mitigating risk described in the first question. Units that rotate into an operational theater occasionally find out about some of the tools and technology developed in-theater that they *fall in on* only after they deploy. By adopting the IM Framework, we facilitate the timely distribution of capabilities across the Army so that the generating force can assess and exercise the capabilities being used by deployed units.

EIS: That depends. We would like to use more of these, but we also must keep in mind that security is a critical issue for us. We think that the Army will baseline on a federated architecture SOA. SOA is all about open architecture and the industry has set the basic standards needed to make this work well. We have security concerns, however, and will need to sort through that in the fullness of time. It would be nice to use open source stuff but we need to be cautious.

FCS BCT: The FCS BCT program developed its most foundational software component, Systems of Systems Common Operating Environment (SOSCOE), to follow the design principles of an open architecture. This has allowed the judicious selection and use of many COTS and open source software components.

This has allowed accelerated development schedules and the potential migration of SOSCOE to other Army systems, representing an opportunity for increased interoperability and war-fighting capability.

GCS: No effect at all since we support highly customized weapons platforms with highly customized support software. FCS is more affected than we are as they plan future weapons systems since their stated goal is to make more usage of COTS and open architectures. But the Army must fight with what we have and our current weapons systems do not use open source or open architectures.

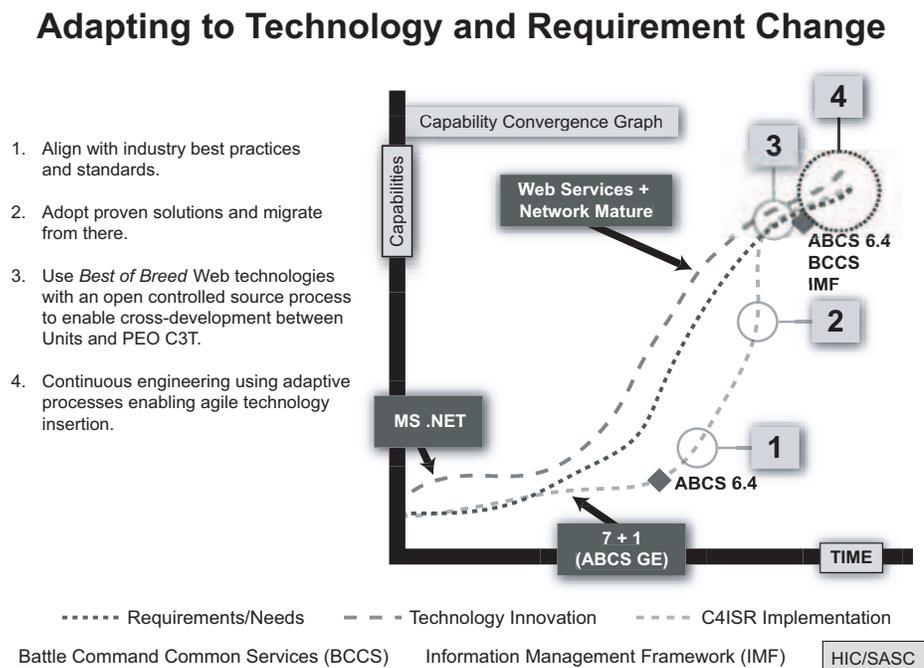
Q: What is your favorite government acquisition success story?

Ammunition: The PM for Intelligent Munitions System made a decision early in the contracting process to maintain a mirror software support environment at the Armament Software Engineering Center and to require periodic software drops so the Army software engineers could have better insight into the progress being made by the contractor, allow for the government to conduct independent testing of safety-critical software, and to ensure proper transition of the software from development to maintenance. This mirror lab is currently paying additional dividends. It will be used to speed up testing, thereby reducing overall schedule.

C3T: Adaptability. The urgent operational needs from our OIF and Operation Enduring Freedom commanders and the Army's conversion to a modular force structure meant transitioning developmental projects into widely fielded and fully supported systems in short order. Blue force tracking, the Joint Network Node, and Command Post of the Future are just a few examples of our recent successes in making that happen. Fundamentally, during wartime, we need to shift our mindset from a focus on ongoing development of our major PORs to a focus on how we can meet warfighter needs in time to make a positive difference.

EIS: Army General Fund Enterprise Business System (GFEBs). Here is an example of a transformational technology being applied in an effective and efficient way. Starting at the very top, the program has the complete, dedicated support of the functional business owner. This is one of those lessons learned. If the business

Figure 1: Satisfying a Critical Subset of Requirements



owners do not support a transformational IT, it will fail. The Army financial business owners made the decision early on to put a lot of effort into the transformation. GFEBS is an ERP, which comes with a host of best business practices. This means change and change management. Although GFEBS is early in its acquisition cycle, it has all the hallmarks of a successful transformational technology implementation. Since there are no lessons learned with the second kick of a mule, we have learned well.

FCS BCT: SOSCOE Make/Buy. Per direction of the Assistant Secretary of the Army (Acquisition, Logistics & Technologies), the FCS BCT program instituted a comprehensive process to evaluate COTS products for purchase (buy), versus the development (make) of custom software products. The process is based on requirements-driven, markets surveys, and life-cycle cost/benefit analysis. There are multiple layers of management review that ensure effective technical and program management oversight. To date, this process has allowed SOSCOE to be developed from approximately 80 percent COTS software.

GCS: One of the best software success stories we have comes from the Abrams System Enhancement Program (SEP) tank. Abrams SEP Version 1 tank software (using circuit boards from contractor A) was quickly and easily ported to the Abrams SEP Version 2 tank (using circuit boards from contractor B). Using a software development approach known as *layering the software*, the porting of software between dissimilar circuit boards was made possible by isolating the software from the hardware dependencies.

Q: If you could make one change in the way the government procures software, what would it be? Why?

Ammunition: I believe we actually need to work on two changes:

1. I would consolidate and simplify regulations and policies with respect to *software* acquisition and recommend that Army PMs use a standard acquisition process model such as the Software Engineering Institute Capability Maturity Model Integration (CMMI®)

acquisition model that is due to be released in 2007. The CMMI acquisition model or some reasonable alternative would ensure that acquisition best practices are used for procuring software-intensive weapon systems.

2. Ensure that software centers are involved from program start to ensure the RFP and Statement of Work properly considers software, data rights, and software supportability. Too often, data rights are not properly considered in the solicitation of a contract. Without data rights, the Army is accepting the risk of not being able to support its system if the contractor goes out of business, changes its business, or defaults.

This over-reliance on a single contractor is not a good business practice and can lead to cost and schedule overruns or, at worst, the inability to maintain the system software.

C3T: It is hard to pick just one as we have learned so many lessons over the last 20+ years on how to do software better. So I will convey my top three interrelated changes.

1. Acquisition processes, to a large degree, are driven by principles established to acquire and manage risks associated with the acquisition of platforms/hardware. Programs are funded as new platforms with unique requirements to be tested pass/fail. The focus is on up-front risk, to get it right the first time, prior to making expensive production decisions. While a good model for platforms/hardware, generally for software this is not the best approach. And increasingly, more systems are becoming software-intensive, if not wholly software, with sought-after warfighter capabilities that are not necessarily new or unique, but evolved. Such capabilities would be better provided (in terms of cost, schedule, and risk) as integrated pieces of software – reused where possible. Software is really a continuous, evolutionary development that is not complete until a system is retired. And then, much of the software should be considered for reuse on the replacement system. To maximize effectiveness, the acquisition process (and life-cycle model) must be one where the Army can accept software as is, build on it incrementally over the life cycle, and do so in an agile manner.

2. We need to use a more holistic strategy (which, by the way, is not necessarily supported by current planning, programming, budgeting, and execution system and acquisition policies/

processes). That is, more and more sought after capabilities, like net-centricity, are not systems but are concepts implemented through numerous technologies, systems, and supporting infrastructure. Similarly, related families of systems (system-of-systems) utilize many of the same/similar functions. However, we keep paying for the same/similar functions to be built over and over. By taking product line approaches and leveraging SOAs, we can build/buy once, centrally manage the software, and successfully reuse these software assets. These approaches, when implemented well, have proven track records in achieving the better, faster, cheaper objectives we espouse and can deliver significant increases in return on investment. This of course brings certain business challenges such as incentivizing industry to reuse rather than rebuild and would require procurement of certain essential government rights, source code, and supporting documentation from prime contractors.

3. We have to take life-cycle software management seriously (with a focus on the sustainment phase). In recent industry surveys, we have validated the fact that industry, having made significant investments in particular software systems, continuously evolves those systems through an aggressive software sustainment program, ensuring that a system continues to fulfill its needs over time, and eliminating need for unnecessary replacement (sustainment = maintenance + modernization). New capabilities (particularly software) can often be inserted into current systems faster, cheaper, and with less risk than procuring entirely new systems from scratch. System replacement (new development) carries a high risk in terms of time and cost. It is not unusual for a company to expend 80 percent of a software system's life-cycle cost in the sustainment phase. In the DoD, we typically see the reverse (80 percent through production and only 20 percent leveraging that capability investment). All of these lessons raise the fundamental question that must be addressed for each new capability: When should we procure new software versus evolve/reuse existing software? The answer to which has major implications.

EIS: A *software depot*. A consolidated, centralized *store* for Army software. One buyer, one seller. Software is one of those

* CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

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Centric Operations
Alexandria, VA*

[www.wbresearch.com/DNCO/
index.asp](http://www.wbresearch.com/DNCO/index.asp)

June 16-20

*ICS 2007 21st Association for
Computing Machinery
International Conference on
Supercomputing
Seattle, WA*

<http://ics07.ac.upc.edu/>

June 18-21

*2007 Systems and Software
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Tampa Bay, FL

www.sstc-online.org

June 24-27

*2007 ASEE American Society for
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Annual Conference and Exposition
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[www.asee.org/conferences/
annual/2007/index.cfm](http://www.asee.org/conferences/annual/2007/index.cfm)

June 25-28

*Better Software Conference
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www.sqe.com/bettersoftwareconf/

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*SERP 2007 International Conference on
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[http://people.cs.und.edu/~reza/
SERP07.html](http://people.cs.und.edu/~reza/SERP07.html)

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unique commodities that ought to be managed at the enterprise level. We know this and we are moving in that ultimate direction. Once we have the *depot* operational, we will have a reasonable chance to manage software like we do repair parts. There must be a lot of savings with that kind of approach.

To elaborate, there are a number of ongoing activities that aim at managing software at the enterprise level. We believe that business software (that is the functional, network, and enterprise software) and IT systems could be managed in the same way as we successfully manage our logistics base in the Army. The highest value target, for example, could be centralized license asset management. If I know where all the licenses are, know where they are needed, and know what is on the shelf (you cannot scan a network to locate these), then I think I could cross-level throughout the enterprise and drive down the total cost incurred when everyone buys their own licensed software. With the maturing capability of Web 2.0 and *software as a service*, we will one day be able look across the enterprise and see where our assets are being used and better manage them. That is a long way off. There are a lot of early efforts under way to do centralized management. In this era of constrained budgets, it might make sense to increase our focus in this area. It is just good business to do this and see how much money we can really save.

FCS BCT: The government, at least the Army, needs to stop buying software exclusively from the traditional defense contracting base. These companies have the overhead costs of manufacturing companies, yet software development should carry a far smaller overhead burden. Most defense contractors are still managed by manufacturing engineers or business managers. Very few of them have software management expertise. By using software-only suppliers who have relevant domain experience and lower-cost government labs, the cost of software can be reduced. This is especially true now that the hardware used by these systems is becoming more standard off-the-shelf types of technologies.

GCS: For our major weapons systems, we typically do not procure software. Instead, we procure systems and subsystems which contain software. However, we recognize that software is a critical component to the modern tanks, cannons, and troop transport vehicles (Bradley and Stryker). Thus, we would like more emphasis on a better,

more formal, and documented process for integrating software upgrades into existing platforms (refer to the software synchronization problems in the first question).

Summary

As I considered the responses to the questions provided, I was struck by the contrast of diversity and similarities in the answers provided by the PEOs. For example, while addressing the *what is the biggest software acquisition challenge you are currently facing* question, the challenges mentioned ranged from technical challenges to business process issues and combinations of both. The criticism of the Software Blocking policy struck me because I have heard this criticism from multiple organizations.

In the second question *how is the GWOT affecting your organization*, one organization is delivering systems more quickly while another's schedules are sliding. One PEO is dealing with a decrease in funding while another is dealing with increased funding. Clearly, the GWOT is delivering a major impact on all of the organizations, and that impact appears to be dependent on how close the product – specific to each PEO – is to the fight. Easily assumed, all of the PEOs are busier due to the on-going GWOT.

Among the PEOs, there seems to be a growing acceptance to open source software and COTS products over time. While security still weighs into these decisions, organizations focusing on new acquisitions are considering the potential benefits of COTS and open source options more readily.

I was especially eager to read about the success stories from the PEOs. The stories discuss acquisition methodologies that look outside the box and have subsequently gotten greater value, through inventive means, for the taxpayer.

As we conclude with requests for change, most of the PEOs suggest ideas that will simplify and consolidate the acquisition process. Hopefully, by sharing this acquisition information, the PEOs' requests for change will be categorized beneath the success stories of the future. ♦

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2. Russell, Alec. "U.S. Army Chief Refuses to Submit Pentagon Budget." *The New York Sun* 26 Sept. 2006 <www.nysun.com/article/40306>.