



Deployment: Moving Technology Into the Operational Air Force

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Ballroom C

Just purchasing and installing new technology does not bring lasting mission value; the real tasks begin only after the acquisition is completed. If we expect to get the full measure of value from our technologies, we must pay close attention to a whole host of issues to ensure that daily operations are enhanced to obtain full utilization of our technology assets.

There are some things America's armed services do really well. No other military force in the world projects resources and power to the battlefield the way we do. We train for wars and disasters realistically, and then we execute the way we trained. We demonstrate the realm of possibilities in our spectacular air shows and say to everyone, "This awe-inspiring display of teamwork shows what training and discipline can accomplish. Would you like to be part of something much larger than just you?" We are able to deliver when it really counts despite a host of problems and challenges, be they problems with new technology, problems communicating, or the most common of all, problems that come from being human.

There are, however, some areas where improvement would be helpful and within the realm of possibility. More practice understanding, communicating, and coordinating could reduce parochial behavior between stovepipe and functional communities. We have wonderfully effective teams, yet many leaders and team members fail to appreciate what it takes to form a truly high-performance team that can sustain consistent execution at what often appears to be superhuman levels.

Oftentimes, we hold too closely to the paths and the techniques that got us where we are and fail to embrace change when it is truly a win-win proposition. In the domain of software-intensive technological systems, which form the core of our military capabilities, our warriors and those who support them often face the prospect of changes to the status quo. Unfortunately, we are not always as successful as we could be. We might consider looking at how the operational U.S. Air Force excels in addressing change and ask why we cannot employ those lessons in our own domain.

A case in point is the deployment of a new software-intensive system into a wing command post. All too often, from our perspective, it appears as if the task of tran-

sitioning new technologies and mission capabilities into operational use ends with the physical delivery of the system. (We have this image of a C-130 low-altitude parachute drop late at night, and then learn that the system has been deployed the following morning on CNN Headline News!)

We know this is not the method used to deliver a new aircraft or other more traditional weapon systems. From numerous field tests to tremendous amounts of operational training, the operators, air crews,

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and commanders for these new weapon systems are fully prepared for live combat before anyone would say their systems have been fully and effectively deployed. Why cannot the deployment of new software-intensive systems into wing command post operations follow the same proven process?

From our perspective, the way the Air Force deploys troops and assets for combat is close to perfection. Rather than focus on the differences, focus on what we can learn and what we might adapt to improve how we deploy mission-critical software-inten-

sive systems into the command post.

How Does the Air Force Deploy for Combat?

At the heart of the Air Force's capability to deploy for combat is a standard process that serves in training as well as in real-world situations. This process demands realism and skills development in the context of their use. Backing up this realism is independent and objective observation, which provides real-time performance feedback and reinforcement. When people perform as instructed, opportunities become available. When performance differs from what others expect, there are consequences: more training and evaluation. Repeated shortfalls result in career consequences.

The Air Force cannot afford to have creative solutions to standard problems without careful coordination. Costly lessons we have learned about the fog of war necessitate that everyone must operate on the trust and faith that everyone else is doing what they are expected to do. Uncoordinated creative solution deviations often mean equipment and, more importantly, people, are not where they are supposed to be. The consequences of this in actual combat are dire.

The list of critical components for the Air Force's deployment process begins with the individual. Is the individual properly trained and equipped with the tools to perform the mission? Has the individual completed all legal and other family preparations so these concerns do not become awkward distractions? Have all medical precautions been honored so that the warrior is truly ready for worldwide duty?

With a properly prepared group of individuals, the team becomes the next focus. Teams train for deployment together, they go through the pre-deployment process together, and they deploy to combat together. Upon arrival, they will live together. The training makes the situation seem

familiar, and the presence of teammates reinforces that familiarity. Everyone supports one another to honor their roles and responsibilities, just as they were trained.

Prior to actual combat operations, the current rules of engagement are reviewed and made personal. What actions are permissible, and what implementation options are there? Backing up the rules of engagement is the commander's intent, which is a description of the purpose of the operation and its intended end state. The commander's intent helps to explain what the commander wishes to occur, so that everyone is equipped with additional information to help fill in the blanks. Oftentimes, reality provides a situation well outside of the bounds imagined by those who created the explicit guidance or the rules of engagement. Commander's intent is key to helping personnel to navigate these situations in which some or all of the rules may no longer apply, or no longer provide sufficient guidance.

The moment the transport stops moving at the deployment point, the set-up phase begins. From securing the site from hostile action to the more mundane acts of providing for water, food, latrines, and places to sleep, everyone plays a role and takes part honoring many months of practice.

From a secure and properly established base of operations, warriors fight and learn from each engagement. How can the mission be performed so that the warriors and resources are available to ensure not just a successful operation today, but tomorrow and the next day, until the conflict is over?

A recurring issue is the shifting list of unknowns and the often more troubling unforeseen unknowns. Survival depends on recognizing new patterns and appreciating that proven solutions may become obsolete at the most inopportune times. Knowing when to stop *Plan A* and resort to *Plan B* is not something that can be easily taught, yet it is a skill that must be mastered.

How We Should Deploy

Technology for Operational Use

The successful principles used to train combat warriors are not being used to train information technology (IT) personnel to be successful in using new software-intensive systems being deployed. It is natural to assume that a console operator with years of experience should be able to figure out the features of a new system, yet no one would be so cavalier when it comes to aircraft and pilots. Certifications and qualification on one type of aircraft mean little when it comes to a new type of aircraft. If

the proper certifications and qualification for a particular aircraft have not been earned, the warrior is not combat-ready in this new aircraft. Given the critical role that many software-intensive systems play in our operations, can we really believe that mistakes in this domain are not as devastating?

Since systems and their roles are so different, no single path to success is possible. Therefore, we should interpret the success of the Air Force combat-deployment process into a series of questions for those who are charged with deploying software-intensive systems into the operational Air Force. If we follow the process for combat deployment, the deployment of a new software-intensive system begins with the individual as follows:

- Are all individuals properly trained, certified, qualified, and skilled to the degree that the individual is predictably able to perform the new roles and honor the new responsibilities demanded by the new system? Is this training at the same breadth and depth as typically employed with more traditional weapon systems?
- Has the individual been trained in a team setting with the same team likely to use the system?
- Has the team had enough realistic training, performance evaluation, and feedback to ensure mission capability?
- Have clear rules of engagement been defined so it is clear to each and every member of the team (and those who lead them) what is to be done, how to do it, and how to employ the commander's intent when issues fall outside the scope of the planned scenario?
- Does everyone have a clear understanding of the following:
 - The new system's role.
 - What kind of information does it provide?
 - Who needs the information?
 - The key interfaces and outputs for the system.
- Has the new system changed the nature of the work being performed?
- Has everyone participated in the activities to put everything together properly and ensure it is working as it worked in training?
- Has everyone who must work seamlessly together moved from the old way of thinking and acting during pre-deployment to the new way of thinking and acting now that the system is about to go operational?
- Once the system goes operational, how do we ensure that we are honoring our

training, the rules of engagement, and the commander's intent?

- How do we distinguish between the normal jitters and the real performance problems of our people on the new technology? (There are a lot of warriors out there who are able to provide solid advice on this.)

Experience From a Command Post

We offer the following real-world experiences as an example of lessons learned about the efficient deployment of software-intensive mission systems. While the example is simple and the solution might appear obvious, the fact remains that it was a serious operational problem that required significant time and resources to correct.

A wing command post has access to a wing commander and his or her staff at any time and any place, day or night. This is a unique role given to no other unit, and carries with it tremendous responsibility and mission-critical consequences.

Accurate and efficient notification to wing leadership is one of the primary responsibilities of the command post. In order to achieve this, three things are required: accurate and complete information concerning the situation, efficient and timely contact with wing leadership, and effective communication of pertinent information.

One of the authors was a command post chief whose early days were riddled with complaints that his troops were not executing their notification duties very well.

Upon investigation, the three requirements listed above were assessed. Collecting accurate and complete information about situations was not the problem; analysis of the complaints verified this. There were checklists covering almost every conceivable situation, and the author's controllers had most of them memorized by heart. They could instantly locate the appropriate checklist, and documentation showed that they accurately recorded all the pertinent information related to each event.

Achieving efficient and timely contact with the appropriate leader was not the problem either. The command post has a large screen on the wall that displays all contact information. Every wing leader is listed along with their current location, current contact phone number, and every other means of contact available. As leaders go about their activities, they update their contact information and location each and every time it changes. Change logs and related documentation showed no problem

here. An assessment revealed that the problem was in the effective communication of pertinent information between command post controllers and senior wing leaders.

Some context is required to fully appreciate the scope of this problem and the complexity of solving it. Command posts are generally staffed with young, inexperienced, and relatively lower-ranking individuals. They are still learning what the Air Force is all about and often do not even realize the criticality of their duties. Because of their age and limited experience, most controllers lack confidence in their abilities to interact with senior leadership. When you consider that their primary customers are very experienced field-grade officers in leadership positions, it is easy to understand the pressure and intimidation they feel when trying to communicate mission-critical information in pressure situations.

The study showed that, under pressure, young and inexperienced controllers would often make incomplete and inaccurate statements. It characterized the problem as one of *frame of reference*. Due to a lack of knowledge and lack of experience, there was no way for these young controllers to know what information was most important for the leader to know. The controller, having no insight to the questions the leader needed to answer in order to take appropriate action, was not able to wade through the data already collected in order to highlight the truly important facts. Having never been in a wing leadership position, the controller did not have the necessary experience to craft a proper message to support the leader's thought process about what action to take in response to the situation. To make a bad situation worse, these incidents always seem to occur at 3 a.m. when the general is sleeping and the spouse answers the phone!

A review of the training program, employing the checklist above, revealed shortfalls that led to the current performance issues. The training program focused on what information to collect, and on ensuring it was accurately recorded. Controllers were well trained to make efficient and timely contact and were provided with the necessary tools to accomplish this. When it came to effective communication of pertinent information, however, training failed to give the controllers the skills and confidence they would need to perform adequately. While there was scenario training that taught the proper identification of checklists, collection of pertinent data, and taking proper actions, controllers were never required to practice their communi-

cation skills or never given specific experiences to develop knowledge and insight that would enable them to craft more value-added messages.

The solution was to modify the training to provide more mission knowledge and insight, and to emphasize the development of their real-time skills. Scenario training was expanded to include mock phone calls with, among other things, a belligerent and sleepy general and a list of likely concerns about the event. A confidence-building component was also added to the training that served to empower the controllers to be more than just a relay mechanism. Their role is not just to pass on information; rather, it is to assist the leader to take the appropriate action in a timely manner. Depending on the situation, the controller is often more knowledgeable about the proper course of action than the leader they are talking to.

Controllers are experts in emergency actions and responses whereas wing leaders generally are not. In these situations, it is imperative that the controller be able to assume the proper role of an advisor and make specific recommendations to the senior leader. Without the confidence that they were an active and contributing component of the process and fearful of making technical mistakes with the data, our controllers were unable to perform their critical role effectively.

The results from the changes to the training program were outstanding. Controllers gained the confidence necessary to not only execute their duties more effectively, but many also became quite comfortable speaking with the wing leadership. Seeing the new confidence from command post controllers, wing leaders softened their demeanor, which further removed pressure leading to even better performance. In fact, many wing leaders began to know most of the controllers on a first-name basis. This was certainly a confidence and morale boost for the troops as they began to receive informal recognition for their efforts and improved performance.

It is common for warriors in IT jobs to be trained in the technical aspects of the job (e.g., the equipment, the data, the procedures, and the checklists) and not in how these systems are being used by others to provide mission value. The application of scenario training that more realistically reflected real-world situations seems obvious, but it was not obvious to the people who developed the previous training. The simple fact is that the controllers had not been trained under the same conditions and circumstances in which they would

actually do the work.

It is also common for people to underestimate the amount of information an event might generate and to ignore the potential benefit derived from reordering information. Armed with the context provided by commander's intent, properly trained and skilled controllers become a powerful data processing component in a complex system. Their understanding and insights can shave crucial seconds from the critical path to an informed decision.

Lastly, it is important to understand who is on the team, the role each person plays, and how to flawlessly interact with each and every one on the team. Excluding the leaders from our definition of team was a mistake. Since the whole team did not train together in realistic situations, we did not have the insights needed to build the trust and confidence necessary to operate at the required performance level. When we applied standard Air Force warrior training concepts to jobs, the same kinds of benefits were achieved.

Conclusion

It is so easy to get consumed with the technical challenges that we forget the painful lessons we have learned over and over again. We in the Air Force have learned that everyone, under pressure, will fall back to behaviors that may not align with current mission needs.

In the early days of aviation, the loss of too many aircraft due to wheel-up landings resulted in creating a specific landing gear checklist item and performing drills upon drills to always use the checklist. The Air Force realized that experienced pilots, under pressure and interrupted in the landing process, were unable to do a perfect context-switch from landing to interruption and then back to landing as required in order to remember which landing stage they were in. Was it the last landing where the gear had already been lowered, or was it this landing where they had not?

The solution to the wheels-up landing problem was not more training about technical aspects of landing and the role of the gear. The solution was to recognize the important role humans play in the total system, to understand their limitations, and to develop mechanisms to help these dedicated warriors to act more perfectly than most would believe is humanly possible.

If our software-intensive systems are critical for mission success, we should leverage proven Air Force methods to ensure everyone performs as required, be it a combat deployment or an IT system deployment. ♦



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Lynn Robert Carter, Ph.D., is a principal fellow at the Institute for Software Research International at Carnegie Mellon University (CMU) where he has been a senior researcher and educator for nearly 14 years. At the Software Engineering Institute, his work included software technology adoption support to numerous Air Force, Navy, Marine Corp, and commercial customers. He is currently supporting the development and deployment of professional master's degree programs at CMU's West Coast campus at Moffett Field, Calif. Prior to CMU, Carter developed software at commercial firms for 17 years.

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BackTalk Answers

1. The Hundred Years' War lasted 116 years, from 1337 to 1453.
2. Panama hats traditionally come from Ecuador.
3. Sheep (sometimes horses) give us catgut.
4. The October Revolution is celebrated in November.
5. Squirrels give us camelhair brushes.
6. The Canary Islands are named for the large number of dogs there. Remember that the Latin word for dog is canis. The original name for the island was Insularia Canaria: Island of the Dogs.
7. no future king be called Albert. Thus, in 1936, when Albert ascended the throne, he respected her wish and took the name King George VI.
8. It's a bright crimson.
9. The tasty berries are from New Zealand.
10. Well, why else would it be named the Thirty Years' War? Actually, there were two Thirty Years' Wars, one from 1618-1648, and another from 1733-1763. The second war consisted of three wars: the War of Polish Succession, the War of Austrian Succession, and the Seven Years' War. The War of Polish Succession was not fought in Poland, but in Belgium, Lorraine, Lombardy, Naples, and Sicily. The Seven Years' War, of course, lasted seven years'.

Notes

1. The Cave Online, "The Thirty Years' Wars." <www.thecaveonline.com/APEH/thirtyyearswar.html>.
2. Bryson, Bill. *The Mother Tongue - English and How It Got That Way*. Perennial Press, 2001: 49 Footnote.
3. "Birthday of Queen Elizabeth II, the Queen of Australia" <www.statustquo.org/birthday.htm> and "Frequently Asked Questions About Queen Elizabeth II" <[www.mun.ca/library/Elizabeth II](http://www.mun.ca/library/Elizabeth%20II)>.

11. Gotchal! He was the son of a Roman Welsh. He ended up in Ireland after being kidnapped at the age of 16 and taken there by Irish pirates.
12. Comes from China, of course.
13. Well, she was born in April; April 21, 1926 to be exact. However, in Britain her birthday is officially celebrated on the third Saturday of June. In Canada, the Queen's birthday is celebrated on the Victoria Day holiday in May. In Australia, the Queen's birthday will be celebrated this year on Monday, June 9, 2003, with the exception of Western Australia, which will celebrate on Monday, Sept. 29, 2003.
14. Your call.
15. Well, OF COURSE!