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WORKING PAPER

RSTA Grid Study Report

February 2007

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Hicks & Associates, Inc.

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RSTA GRID STUDY REPORT

BACKGROUND

The Reconnaissance Surveillance and Target Acquisition (RSTA) Grid study consisted of two parts. The first was a comprehensive examination of the technologies involved with the RSTA Grid in order to determine if the state of the art had moved beyond the relatively primitive conditions existing when the concept was last examined in 2001. The second portion of the study was a war game examining the most promising portions of the technology. Finally, at the request of the client, Hicks & Associates, Inc. conducted a workshop to look at potential tactical counters.

A DESCRIPTION OF THE RSTA GRID CONCEPT

Background

For a number of years, various Defense Department agencies have been experimenting with the possibility of linking small covert sensors into a responsive sensor-to-shooter grid that could help shape the battlefield and support maneuvering forces' operations within the grid. During Operations Iraqi Freedom and Enduring Freedom (OIF and OEF), primitive versions of this concept using covert human ground sensors proved to be effective, but the full vision of using covert unmanned sensors in this role remains unfulfilled.

This concept has been the key to several service concepts, particularly the Air Force Persistent Area Denial Concept and the Marine Corps Warfighting Lab's RSTA Cloud approach. In the late 1990s, technology was not yet mature enough to implement the concept, and it remained a long range concept. However, in the last five years sensor technology, particularly in the areas of power source miniaturization and bandwidth capability, have made great strides. The basic characteristics of the notional RSTA Grid are:

- It consists of networked group of covert sensors tied to a pool of precision shooter units.
- Human decision makers monitor the sensors to make shoot-no-shoot decisions (man in the loop).
- Some sensors can be covert human assets but most would be robotic or micro systems.
- Any sensor has to have a visual feed for target ID.

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The RSTA Grid would be of enormous help in augmenting scarce manpower in urban, line of communication protection, and border security situations in OIF and OEF.

Unresolved Problems from 2001

The problems that could not be satisfactorily addressed in the original experimental series were:

- Lack of long-term power
- Lack of long-term power in general due to limitations of battery size
- Lack of over the horizon (OTH) communications capability, primarily due to lack of power
- Mobility problems in small robotics
- Precision emplacement challenges, particularly in urban environments

DISCUSSION OF THE WORKSHOP

Objectives

The workshop objectives were as follow:

- First, to determine the current state of the art of the technologies of the RSTA Grid.

- Second, to determine if there are near-term applications of the concept that could assist troops in Afghanistan and Iraq or elsewhere in the GWOT.

Observations

There were no revolutionary breakthroughs that have occurred since 2001, but there have been incremental improvements that have potential to help in several missions, including border security.

The current state of the sensors is not ideal, but potentially useful. A combination of a DARPA sponsored program and a Sandia initiative appear to have the best near term promise. The present state has some limitations: First, the sensors are larger than ideal. Second, they would have to be hand emplaced instead of dropped by UAV, which was the desired delivery means in the original concept. Finally, they have very limited use in urban environments in their current state.

The border security application appears to have the best potential for an ACTD initiative that could help in several real-world operational environments.

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A RSTA Grid roadmap is needed. JFCOM appears to have the best potential for leading its development, and they have shown interest. JFCOM representatives were included in the subsequent war game.

Outcome

The participants determined that the next event would be an attempt to present a possible near-tem border security initiative to stake holders, to include veterans of such scenarios to give us a reality check.

The group identified possible ACTD-like sponsors to include the DOD AT&L ACTD office, NRL, and DARPA. The decision was that the next event would be a tabletop war game that would have three scenario cells:

- Iraq-Syria border
- Afghan-Pakistan border
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WAR GAME

Objectives

The war game was conducted from 3-5 December 2006. Its objectives were to determine if:

- There have been significant improvements in the technologies that would enable us to implement the vision of the RSTA Grid since experimentation ended in 2001.
- There are near term applications, and how we can leverage them to help operators in the field.
- JFCOM's Joint Urban Office is interested in knowing if there are immediate urban applications.

Game Methodology

The game participants were a group of individuals with technical expertise and tactical experience in the areas in question. To reach critical mass of tactical expertise, some pre-play was necessary regarding Iraq and Afghanistan. The Red Team consisted of a group of veterans from each scenario that was tasked to identify weaknesses in the concept.

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The tool kit used in the game was a kluge of the best of the near-term systems examined thus far. The generic sensors consisted of thirty device sets that looked like indigenous rocks. They were capable of:

- Being hand emplaced
- Being activated upon sensing movement
- Giving a remote operator a visual image of the target
- Relaying the signal to the remote operator over the horizon
- Allowing remote operator to do a hand off to a precision shooter unit or to a reaction force patrol
- Solar regeneration of batteries for at least a month.

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If participants did not like the ROE, they were encouraged to change it. This was considered to be a key data input.

Observations Drawn From the Game

RSTA Grid and Economy of Force

- We will never get to the truly transformational aspects of the RSTA Grid if we do not solve the near-term challenges.
- A crawl-walk-run approach will likely be needed that includes: employment Concepts, Rules of Engagement (ROE), organizational norms, a command and control that does not stifle the ability to respond quickly to fast moving situations.

Sensor Density

- The RSTA Grid would have identified all of the targets postulated in each scenario.
- The (b)(5) dealt with restrictive terrain, and they believed that thirty sensors constituted sufficient coverage for a forty kilometer frontage.
- The (b)(5) believed that they needed more sensors for the open terrain.

Organizational Implications

- The current technologies appeared superior to the legacy RSTA capabilities that existed at the turn of the century, but Revolutions in Military Affairs generally mean changes in technology, tactics, and organization.

- However, the general consensus among the participants seemed to be that the RSTA Grid does not require radical tactical or organizational change.
- This may mean that the RSTA Grid would represent an evolution, vice a revolution.

Decision Making

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- The (b)(5) also believed that existing Command and Control (C2) and organizational structures could make efficient use of the RSTA Grid without radical changes to exiting organizational norms.
- There was not consensus as to whether the shoot-no-shoot decision should reside with battalion command, or with the Joint Force/ Task Force commander.

Impact of Asymmetrical Tactics

- The counter RMA of asymmetrically masking enemy troops among non-combatants presents challenges to the RSTA Grid (b)(5) (b)(5) but the RSTA Grid does provide another tool to attempt to sort out the clutter caused by this tactic.
- Many participants believed that the intelligence value of the RSTA Grid in giving situational awareness of what is normal and what is not normal will be just as important if not more so in asymmetric environments such as Iraq, Afghanistan, and the Mexican border.

Is There a Near-Term Application?

- The participants seemed to feel that there are near term urban applications of the existing technology, if the sensors can be made covert.
- There was also a view that letting the enemy know we are using the sensors might also be useful in making the enemy more paranoid ("the Blinking Rock" tactic). This idea merits more gaming.
- The homeland security cell was particularly enthusiastic about urban applications, and the participants seemed to feel that there are near term urban applications of the existing technology, if the sensors can be made covert.
- More eyes in the operating area are always better, but the ability to know what we are seeing requires people to monitor the inputs. Operators will have to come from somewhere, and the using organization should know this upfront.

The Importance of Reading a Map and Knowing the Terrain

- The success of such a system would be dependent on the placement of the sensors in an effective manner. This implies good knowledge on the part of the planner regarding:
  - Terrain and situation
  - Enemy patterns
  - Civilian patterns and culture
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Urban Applications

- From an urban perspective, the near term potential of the RSTA Grid are less applicable than for the border scenario examined in the game, for several reasons:
  - The current state of the sensors makes them very difficult to covertly emplace in urban settings.
  - The amount of activity in an urban area would cause the sensor to be "on" for much longer and would likely run down batteries more than a border scenario.
  - It is difficult, but not impossible, to hide the sensors in the urban setting given the current state of the technology.
- However, the RSTA Grid might be useful for isolating certain areas that have already been cleared for economy of force.
- The border applications of the RSTA Grid in an RMA context appear to have real potential in the near term to address situational awareness and targeting problems.
- There are potential near term urban applications of the RSTA Grid, but they appear to be more tactical than operational.
- It does not appear that the implementation of the RSTA Grid approach would require a change in the existing way a using unit organizes in the near term, but it might give them the ability to use much more economy of force in tactical implementation depending on the terrain and situation.

General Response of Participants

All participants who answered the post-game questionnaire believed that a near term application of the RSTA Grid concept would be an improvement over existing capabilities.

CONCLUSIONS

Border Applications

- The border applications of the RSTA Grid in an RMA context appear to have real potential in the near term to address situational awareness and targeting problems.

Urban Applications

- There are potential near term urban applications of the RSTA Grid, but they appear to be more tactical than operational.

Organizational Implications

- It does not appear that the implementation of the RSTA Grid approach would require a change in the existing way a using unit organizes in the near term, but it might give them the ability to use much more economy of force in tactical implementation depending on the terrain and situation.
- No insights could be gained on how the development of more mobile, covert, and capable sensors might cause the using units to change organization and tactics in the future to create a true RSTA-based RMA.

JCTD Implications

- The near term applications merit consideration as a Joint Concept Tactical Demonstration (JCTD).
- The mid term PADS program will give a much more robust urban application than the existing system if it can be implemented in the planned 2010 time frame.

REMAINING QUESTIONS

This section of the report has been set aside to address some near-term questions raised by the sponsor.

- Can the sensors be jammed?
- Can the sensors be located by direction finding?
- Would deliberate use of smoke to mask movement be an effective counter?

These questions require examination that is technically beyond the scope of this study. They will need further exploration in other venues.

IMPLICATIONS FOR THE FUTURE

The state of the art of the RSTA Grid today is very much like that of the artillery in the Middle Ages. It is useful in limited situations. Artillery was used primarily as a substitute for more primitive siege engines in reducing fortifications such as castles. French kings in particular used it successfully to bring recalcitrant nobles into line. Artillery was a useful, if not decisive, tool in ending the feudal system in Europe.

Nonetheless, artillery remained a fringe weapon. It was relegated to private contractors rather than being considered a part of the regular armies of the day. Artillery siege trains

were huge and cumbersome. However, by the Thirty Years' War (1618-1648), artillery had become more tactical and was light enough to be used on a mobile battlefield. Consequently, it was integrated into the regular forces of standing armies.

It took the rise of Napoleon in France to fully realize the tactical and operational relevance of this tool in his kit, and his ability to do so was enabled only by some large technical breakthroughs in pre-revolutionary France.

The real dominating potential of artillery did not come until very close to the First World War when telephone and wireless technology combined with aerial spotting allowed the realization of the true possibilities of indirect fire.

In essence, artillery represented an evolution, rather than a revolution, in military affairs. Its evolution was slow, and it depended heavily on improvements in gunpowder, reduction in the weight of the pieces due to advances in metallurgy, and growing mathematical sophistication. From these technical innovations followed advances in tactics and organization.

Similarly, it appears from this study that the RSTA Grid might be the next military evolution, but in today's world, technologies move so quickly that evolution and revolutions become blurred. The state of the art of today's RSTA Grid sensors is micro, but the breakthrough that makes them nano might only be weeks or months, rather than years, away.

This may go a long way toward explaining why the participants in the war game did not believe that any radical changes in tactics or organization would be necessary. Early artillery was an economy of forces measure. By reducing castles more quickly than conventional siege methods, artillery saved lives. In medieval warfare, the greatest proportion of casualties on both sides was caused by disease rather than kinetic action. The present state of the RSTA Grid is likewise an economy of force proposition.

A VISION FOR THE FUTURE

The full vision for the RSTA Grid may yet require changes in organization and tactical employment. As sensors get smaller and more mobile, we may well see a day when they can provide cultural intelligence by infiltrating rooms and monitoring conversations in areas where conventional "bugs" may be impossible to emplace.

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The developments that artillery made in five hundred years might well be accomplished in RSTA Grid technology in a decade or less.

APPLICATIONS AND IMPLICATIONS

Near-Term Applications of the RSTA Grid

- The workshops and war game would indicate that there are near term applications of the RSTA Grid that would be helpful in the near term in Afghanistan, Iraq, and on the Mexican border.
- It appears appropriate for border and limited urban applications at this time.
- OSD (DDR&E) and JFCOM both have programs designed to render support to ongoing operations – in particular, the DDR&E JCTD program.

Mid-Term Applications

- The Air Force PADS concept seems to have great promise as a mid-term enhancement for urban situational awareness and battlespace shaping.
- A partnership between the Air Force and the JFCOM J-9 Joint Urban Operations Office (JUOO) would appear to be the best venue for pursuing this.

Long-Term Implications

- The full vision of the potential of a RSTA Grid, though still technologically out of reach, could likely be realized much more quickly with an infusion of R&D money, but that does not prevent us from thinking about the long term tactical and organizational implications and being prepared with a concept when the technology emerges.
- This would seem to be a more logical approach that the trial-and-error method applied to artillery development.
- OSD (NA) and the JFCOM (J-9) Futures Group would seem best poised to create a partnership to take the lead here.

RECOMMENDATIONS

Near Term

- OSD DDR&E and JFCOM should work with CENTCOM and / or NORTHCOM to craft a JCTD-like mechanism to do field development of existing RSTA Grid technologies.

Mid-Term

- JFCOM JUOO and the Air Force should partner to explore joint urban applications for PADS.

Long-Term

- OSD (NA) and the JFCOM J-9 (Futures and Concepts Groups) should partner to develop long term concepts for the mature RSTA Grid.

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