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MILITARY OPERATIONS RESEARCH SOCIETY



MORS Workshop Analysis Of Urban Warfare

October 2-4, 2001

Johns Hopkins University
Applied Physics Laboratory

Technical Co-Chairs: Ted Smyth and Greg Keethler

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Background

The importance and relevance of cities to future military operations in which the United States (US) may commit its forces has been the subject of considerable debate. Some argue that combat in cities must be avoided at all costs while others suggest that we will be unable to avoid urban deployments short of war and even full-scale city combat.

While it is impossible to predict with any degree of accuracy the type or location of future 21st century conflicts, it must be recognized that our military history is punctuated with the names of cities — Seoul, Saigon, Hue City, Panama City, Kuwait City, Mogadishu, Port-au-Prince and Sarajevo. Images of dead and wounded US military personnel in urban areas have appeared on television screens in marked contrast to the almost sterile videos of precision-guided munitions finding their mark against tanks arrayed in open deserts or entering the window of an enemy building.

Unfortunately, if demographers and political strategists are correct, the reality is that many, if not most, of the military operations of this century will be conducted in and around large urban areas. The United Nations (UN) predicts that by 2025, 60 percent of the world's population will be found in urban areas. Moreover, it is already a fact that urban sprawl impedes many important military operational lines, as evidenced by Korea's western corridor, the German Ruhr, the Shanghai-Beijing corridor, the Ganges valley and the Boston-Washington corridor. In addition, many cities are now too large to permit evacuation and offer no sanctuary for displaced residents, as is apparent in Singapore, Hong Kong, Calcutta, Tokyo, Seoul, Lagos, Mexico City and Los Angeles.

Recognizing at least the potential for the future commitment of US military power into urban areas, the House Armed Services Committee, has recently directed the Secretary of Defense to designate an appropriate executive agent with the authority to develop and coordinate a master plan for a DoD wide strategy, with milestones, for improving service and joint capabilities to conduct military operations in urban environments.

The rationale behind such guidance is clear. Future joint urban operations will be planned and conducted across the entire range of military operations from the tactical to the strategic levels. Joint urban operations may be part of a campaign or compose the entire campaign itself, and may well require the synchronization of all instruments of national power (diplomatic, economic, military and information) to achieve strategic, operational, and tactical objectives. These varied forms of joint operations will be focused on a complex topography and its adjacent natural terrain where manmade construction and the density of noncombatants are the dominant features.

Such an urban environment poses significant and unique challenges to future military operations. Combat operations associated with this environment will be multidimensional in character. Combat may encompass operations at street level, in and from the airspace or beyond it, on roofs and in the upper stories of buildings, and below street level sewer systems, subways, and other underground structures, and in cyberspace.

The broad-ranging features of the urban environment significantly impact the organization and employment of joint and coalition forces; challenge our Command, Control and Communications (C3) capabilities; put a premium on accurate and timely Intelligence, Surveillance and Reconnaissance (ISR); impact our weapons employment options; degrade our ability to maneuver; and affect our overall approach to achieving strategic and tactical objectives in the presence of large numbers of civilians in the battle area. Hence, our ability to assess and analyze the nature of joint operations is essential if we are to assist decision makers in preparing for and conducting joint urban operations.

Although urban warfare has served as the subject of extensive analysis over the years, most practitioners of Operations Research (OR) agree that the analytical tools and methods available to quantitatively understand and evaluate the demands of joint urban operations are severely lacking in the context of new warfighting concepts, operations and systems. Consequently, the complex analytical challenges posed by future joint urban operations across the spectrum of conflict, warrant the immediate attention of the military operations research community.

To address these issues, the Military Operations Research Society (MORS) sponsored the Analysis of Urban Warfare workshop during 2- 4 October at the Kossiakoff Center at the Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland. Mike Bauman, Director of the US Army's Training and Doctrine Analysis Center was the General Program Chair of the Workshop.

Objectives

In keeping with the 2001 MORS theme of supporting and reaching out to decision makers, the workshop focused on the following objectives:

- Gain an understanding of the basic characteristics, challenges and decision needs of current and anticipated joint urban combat operations.
- Assess the needs of decision makers.
- Perform an assessment of our knowledge, methods and existing data, relevant to joint urban combat operations.
- Provide a list of candidate actions necessary to acquire relevant knowledge and data and to develop appropriate analytical tools and methodologies in order to more effectively analyze and assess future warfighting concepts, operations, forces and systems employed in an urban environment.

Organization

Organizationally, the workshop was divided into both plenary and working group sessions with the intended purpose that the plenary session on 2 October and luncheon speakers would accomplish the first two objectives listed above. Working group sessions on 3 and 4 October, led by a distinguished group of MORSians, focused on the following areas: force packaging and projection; ISR; C3; force protection; application of force; mobility and maneuverability; support and sustainment; and, synthesis/integration.

Ted Smyth, President-Elect of the Society, served as Technical Chair of the workshop and Greg Keethler served as Technical Co-Chair. In his introductory comments Mike Bauman observed that the workshop's topic was timely and as such appealed to the participants to identify ways for members of the OR community to best contribute their skills and creativity to the formidable challenges of urban warfare. With this guidance, the stage was then set for the workshop by arranging what is arguably one of the best plenary sessions at a workshop in recent memory.

Plenary Session

The workshop was most fortunate to have as its Keynote Speaker Major General John Barry, USAF, the Director of Strategic Plans on the Air Staff. General Barry opened his remarks with some cogent observations about the September 11 terrorist attacks and their implications not only for the nation as a whole, but also how they will shape the future defense of the nation. A major element of that defense will center on urban warfare, which represents a key element of asymmetric warfare that terrorists and others are likely to wage against the US. General Barry noted that historically the Department of Defense has had a tactical focus on urban warfare, which was typically conducted under conditions of limited situational awareness, resulted in high casualties among combatants and non-combatants alike, and frequently resulted in high levels of collateral damage that caused extensive destruction of valuable infrastructure. Current military thinking is to balance the focus on the house-to-house level of urban operations with a strategic and operational level focus, emphasizing continuous situational awareness to achieve lower casualties, minimize collateral damage and to preserve existing infrastructure. Key to achieving these goals are Effects Based Operations (EBO) that emphasize Intelligence Preparation of the Battlefield (IPB) and Predictive Battlespace Awareness (PBA). General Barry then expounded on the concept of Understand, Shape, Engage, Consolidate and Transition (USECT) and how the Air Force in a joint operation can and will contribute to each of these areas in the future. According to General Barry, it is anticipated that through investments in and emphasis on overhead architectures, command and control, mobility, and a new family of standoff, highly precise munitions that produce less collateral damage, there will be orders of magnitude improvements in our ability to prosecute operations in the joint urban battlespace.

Dr. Williamson Murray of the Institute for Defense Analysis and Dr. Russell Glenn of RAND (a prolific author on the topic of urban warfare), then presented a very cogent historical context of urban warfare. Dr. Murray discussed urban warfare from ancient times through World War II with an eye on what has changed over time. He provided two major observations:

1. Political prestige has come to guide strategy more and more by forcing entanglement of armies and political leadership through urban warfare.
2. The realization that cities afford the inferior combatant with the ability to maximize their potential while minimizing that of their enemy.

Dr. Murray posited that these trends continue today, and that four factors combine to make cities important:

1. Geographic placement.
2. Logistical importance.
3. Psychological importance.
4. The association of cities with national existence.

Dr. Murray then recounted three case studies, from which he concluded that, like it or not, US forces will likely be engaged in urban terrain in peacekeeping missions, low end insurgencies, rapid decisive operations, and in a major conflict. Although such operations are impossible to predict as to when, where, or against whom they will occur, we must prepare to do better.

Dr. Glenn also presented a historical context and challenged the OR community to both develop competing paradigms and expand urban operations theory by pursuing research in seven areas:

1. Cultural awareness — implications for preparing a deploying force.
2. Casualty exchange relationships and the effects of Rules Of Engagement (ROE).
3. Medical support of urban operations.
4. Integrating information operations during urban operations.
5. Logistical support of urban operations.
6. Synchronizing C4ISR (to include targeting) in built-up areas.
7. Intelligence support to joint urban operations.

Dr. Glenn then expounded on two issues that are particularly cogent in any analysis of urban warfare — namely, critical points and density — and he did so by putting these into the historical context of Hue City, Panama City and Vukovar urban operations. He closed with a help wanted ad that brings home an important point for all of us to remember in these difficult times: “Innovative but pragmatic operations research gurus needed to solve myriad problems, both identified and lying in wait. Objective is preservation of the good, protection of the innocent, and a better future for all mankind.”

The luncheon speaker on 2 October was Major General Carl Ernst, US Army, (Ret), who recounted his experiences as Commander, Joint Task Force (JTF) Somalia. He gave a first hand account of the difficulties presented by a host of problems, ranging from ROE (declaration of placing a machine gun in a pickup as a “hostile act”), to the presence of media (camera crews were on the beach to film the Marines’ landing), to the challenge of controlling and addressing the needs of the civilian population, to the problem of keeping track of the ever-changing urban terrain. General Ernst’s personal observations gave the attendees a palpable sense of how operating in urban terrain magnifies the difficulties of every aspect of a military operation.

The afternoon featured a Military “Warfighter” Panel whose members related their first hand experiences in urban operations. Nick Warr, author of *Phase Line Green*, related his experiences in Operation Hue City. Mr. Warr highlighted several aspects of urban warfare that analysts should account for — namely, that the ROE tend to change over

time, that extraction of casualties takes even more riflemen out of the fight, and that the elimination of the enemy's command and control capability, at least in the case of Hue, was crucial to the victory.

Lieutenant Colonel Colin Beadon of the British Royal Marines followed with a presentation of his experiences with British forces in Northern Ireland. This was a most interesting perspective because it dealt with the challenge of suppressing and controlling a terrorist threat in an urban environment. Colonel Beadon emphasized the need to understand the goals, objectives, mindset and methods of the terrorist enemy, and how tactics on the ground must be focused to countervail them. He also emphasized the criticality of unit training, the importance of intelligence, and the crucial role of controlling the high ground (i.e., tall buildings) in the urban environment.

Lieutenant Colonel Beadon was followed by COL Bill Huff, US Army (Ret), who in addition to being an operations analyst, was a battalion commander on the ground in Panama City during Operation Just Cause. COL Huff provided the historical context of the conflict, the planning of the operation, and its execution from his perspective as a ground commander. He left the audience with some very cogent lessons learned — or, as he said it, lessons “re-learned”: clearing and securing a built-up area is not only extremely manpower intensive, but it is immensely complicated by the presence of civilians, and can be even further complicated by restrictive ROE. He also relayed how, as analysts, we can help operators anticipate. As an analyst on the Southern Command (SOUTHCOM) staff for three years before the operation, he was able to advocate the digitization of maps of the area in and around Panama City, and he was subsequently able to obtain the JANUS wargame simulation to operate on those maps and show the critical impact of time and distance relationships to the operational plan.

Ambassador Robert W. Farrand then related his experiences as the Supervisor of Brcko and Deputy High Representative in Bosnia and Herzegovina. His presentation consisted of a fascinating account of how he faced a situation of attempting to control an area that evaded agreement between the two sides during the Dayton Peace Accords — all that could be agreed upon was that there would be a civilian supervisor put in charge of the area, and that job fell to the Ambassador. His account of the challenges associated with exerting control over the civilian populace and the warring factions among them emphasized the importance of an often, overlooked aspect of urban operations. Ambassador Farrand challenged MORSIans to be mindful of what comes after urban conflict, how civilian control can affect military operations during that period, and the short and long term lingering effects of warfare on an urban area. He closed with a quote from T.E. Lawrence: “It is better to let them do it imperfectly than to do it perfectly yourself, for it is their country, their way, and your time is short.”

The final “Warfighter” Panel speaker was Major Shane Gabriel, Australian Army, who related the experiences of Australian forces in the recent unrest in East Timor. This highly successful operation also revealed some lessons learned that were quite consistent with those offered by the other panelists. In particular, he highlighted that the need for training in complex urban terrain is paramount. Major Gabriel also addressed the

difficulties in dealing with civilians, the challenge of securing buildings, the challenges presented by the threat of disease, the variety of urban terrain (high rise buildings to shanty towns), and the challenges of adapting equipment meant for other purposes.

The eight working groups convened on 3 October and immediately began addressing the workshop objectives for their respective areas. At lunch, Dr. Darryl Greenwood, from MIT/Lincoln Labs, a member of the Air Force Scientific Advisory Board (SAB), gave a presentation that had been recently delivered to the Air Force Chief of Staff. The subject of his briefing was the SAB's Summer 2001 Study on "Sensing Difficult Targets," one type of which was urban targets. Dr. Greenwood highlighted the uniqueness and some of the special challenges presented by the urban environment, ranging from some of the detection challenges (e.g., restricted line-of-sight, the mixing of friendlies, unfriendlies and the actively hostile, etc) to the need for high-confidence solutions to accommodate the US aversion to collateral damage, to the need for timely and precise target identification and location, and to the necessity of Battle Damage Assessment (BDA) and rapid retargeting. He then noted that the Air Force's current capabilities against most of the urban target set is deficient, and related a series of vignettes which led to the studies recommendations:

1. Develop tailored CONcepts of OPERations (CONOPS) and technologies to support urban operations.
2. Evolve a persistent overhead sensing architecture for three dimensional urban IPB/PBA and an approach to multi-source data fusion that provides full, timely, situational awareness.
3. Develop targeting, BDA, and Command and Control (C2) technologies to enable precision weapon delivery to achieve surgical effects and deny adversary use of urban infrastructure.

Just prior to adjournment on 3 October, Dr. Alfred Brandstein, Marine Corps Combat Development Command (MCCDC), gave a presentation to all participants entitled "Analysis for the Brave New World." Consistent with the theme of the Marine Corps' Project ALBERT effort, Dr. Brandstein challenged the adequacy and utility of many of today's analytical capabilities to include: equation based approaches; simulations; and, non-reproducible seminar war games. Dr. Brandstein then suggested that the OR community support new and innovative analytical approaches such as: the "capture (of) non linearity, intangibles and co-evolution; data farming and operational synthesis; and work to develop models with the following characteristics: transparent, accredited, transportable, 'Gaussable,' applicable and adaptable."

Working group deliberations continued until just prior to lunch on 4 October, during which LTC(P) Anderson, US Army, a member of the faculty at the Naval War College, gave a presentation entitled: "Urban Operations: Combat Versus MOOTW — What's the Difference and How Can We Do It Better?" During the briefing Colonel Anderson compared and contrasted his experiences in the Panama and Kosovo operations to yield some recommendations in the areas of tactics/concepts, combat technologies and decision making tools, with the latter area being of particular interest to the audience. In that vein, he touted the virtues of the Enroute Mission Planning and Rehearsal System, and made a

case for an enhanced position locating system, a tactical internet, and a satellite based tracking system.

Working Groups

The remainder of 4 October was reserved for reports from the eight focused working groups. Gene Visco, FS, graciously substituted as the chair of the Force Packaging and Projection group, ably assisted by Lieutenant Colonel James O'Sullivan, UK, and other analysts and functional area experts. The group began its deliberations by asking the question as to whether urban warfare requirements are different and if so, how and why. To answer these questions the group attempted to determine the broad overall requirements of the joint force in the urban environment. In this effort, consideration was given to a number of factors, including: deployment/access via airports, ports and routes; recognition that the urban population is a focal point of any operation and may be a center of gravity; the threat may attempt to draw joint forces into the urban area to minimize its technological advantage; humanitarian support may be required; and, the impact of political decisions. The group then proceeded to consider these factors at the strategic, operational and tactical levels. By means of this process the working group identified a number of issues that may be viewed as deficiencies in terms of the joint force's ability to properly size and project the force. These deficiencies include: inadequate cross government, coalition and Non Governmental Organizations (NGOs) planning and organizational processes and tools; the need for improved data and data management; the lack of suitable urban ISR capabilities; inadequate lift and sustainment capabilities; and, inadequate training and campaign analysis tools. The group went on to conclude that the OR community can assist in addressing many of these deficiencies. Accordingly, future OR support should include efforts to develop analytical capabilities to: assist in the refinement of urban warfare issues and requirements and the prioritization of same; evaluate future scenario force requirements and structures; and, assess training/readiness needs of potential force packages.

Corinne Wallshein chaired the working group focused on ISR. She led the members of her group in addressing the problem in the context of the Mission/Enemy/Terrain/Troops-Time/Civilians (METT-TC) framework. They discovered eleven complexities/issues that compound ISR in urban warfare, ranging from information feedback time to real-time media reporting to managing density (both the number of players and information content of the environment). The group then identified the key decisions that need to be made, which include go/no go mission decisions, resource allocation decisions, defining criteria for success, and how low the authority to make certain types of operational decisions should be delegated. They then assessed what the OR community can contribute to these decisions, and identified the following:

1. MORSS social sciences working group (WG 32) should address the psychology of Joint Urban Operations (JUO) in terms of economics, political science, group behavior, etc.
2. Analyze Lessons Learned (recorded in Joint Universal Lessons Learned System and Center of Army's Lessons Learned).

3. Take advantage of Computer Science technologies to bring together different physical and OR models of the environment to simulate JUO actions and responses (for various missions) for re-use.
4. Survey available data and tools being developed to ensure a good interface to analyze projected rapidly changing events.
5. Conduct experiments with ISR (configurations, support to JUO missions, resources).

The group then identified the OR tools and techniques that could be applied to contribute in these areas, including influence diagrams, Bayesian belief networks, complex adaptive systems, discrete event simulation, and application of optimization techniques to sensors (for planning and execution: types, allocation and location). They also identified the following shortfalls in the OR community's ability to contribute to effective ISR: inadequate OR problem definition and ISR requirements definition; lack of decision support tools for IPB, PBA and targeting; fusing data — need to gather more data to help; defining metrics, such as public perception, casualties (enemy, friendly, non-combatant), casualty ratios, collateral damage, mission success, and degree of understanding (situational awareness; actionable information); and, the need to conduct humans-in-the-loop experiments to define JUO mission requirements and MOEs. This led the group to make the following recommendations to the JUO analyst community:

1. Undertake an integrated effort to solve the problem
2. Establish definitions and descriptions needed (define ISR Requirements and Tasks; conduct experiments in JUO; and set up presentations from JUO participants on exercises, experiments, past operations, current operations and planned operations).
3. Develop tools such as models and other techniques to analyze ISR in JUO.

The desired end state of these efforts is seen as the attainment of OR capabilities for decision makers that will enable the ability to answer ISR questions with all the necessary supporting data, tools, MOEs and training.

Steve Upton and Scott Bamonte led a group of ten MORsians and functional experts in an exploration of the C3 aspects of urban warfare. They addressed the uniqueness of urban operations and assessed that OR could contribute in the context of C3 in the following ways:

1. Assist in evaluating various future force organizations.
2. Analyze C2/C4 systems effectiveness (current/new).
3. Assess effectiveness of policies/ROE.
4. Help develop Tactics, Techniques and Procedures (TTPs) in terms of current/future doctrine/operations, general/specific urban settings.
5. Analyze/assess force packaging (all levels, theater down).

The group then assessed that the OR community's current capabilities to do these tasks is deficient, particularly with regard to modeling, understanding and influencing the behavior of individuals, groups, organizations and bureaucracies (the group recognized this to be the most difficult and demanding task associated with C2 and urban

operations); 3-D modeling of the urban environment to account for multiple surfaces, composition of objects, internal and external features, etc; and the lack of good/appropriate measures of effectiveness. The group provided four recommendations to the JUO analyst community to address these deficiencies:

1. Study/evaluate current/near-term tools for assessing/modeling urban operations.
2. Identify new MOEs (military and nonmilitary).
3. Identify data and modeling shortfalls.
4. Conduct OR analyses/models of past urban operations.

Dale Malabarba addressed the issue of the force protection aspects of urban warfare and with the assistance of Co-Chair Hank Kinnison and seventeen members of the group tackled what is indisputably one of the most important issues in joint urban operations. The group represented a cross-section of developers, testers, members of the intelligence community, medical/survivability specialists and analysts. The group received six presentations on various aspects of force protection, and concluded that the uniqueness of force protection in the urban environment is driven by a highly variable and complex mix of threats; greater density of populations, troops and structures; exaggerated complex terrain and environment; increased difficulty in combat casualty care and evacuation; and increased logistical burdens. To address these issues, the group suggests that the OR community contribute in the areas of information acquisition and usage, distribution and linkages; integration of relationships among warfighting capabilities; answering "So What" and "What If" questions; identifying data sources and serving as information brokers, and enhancing extant M&S tools for all domains. They then assessed the areas of lethality, survivability, mobility, command and control and sustainability to determine how well the OR community can address these areas in the context of force protection. Capabilities were categorized as either a current capability, a near-term achievable capability, or a significant challenge. Based on this analysis, the group identified three key shortfalls:

1. Knowledge of the phenomenology of the urban battle.
2. Data availability and sufficiency.
3. Tools and measures.

This led to the following recommended actions for JUO analysts:

1. Create a characterization of urban environments.
2. Develop a behavioral basis for intelligent agent software.
3. Develop a brokering network for information (e.g., DoD Trauma Registry for Operational and Medical Casualty Research).
4. Explore decision making for a knowledge-based force in urban combat.
5. Strengthen the link between test and OR communities to assure data availability for analysis.
6. Develop new and improved methodologies.

The Application of Force working group was chaired by Mike Carothers, ably assisted by co-chairs, Vic Middleton and John Galloway. They led a group of over twenty MORSIans and functional experts in examining this important aspect of joint urban operations. Their approach was to identify six decision areas: research, development and

acquisition; force structure; training; policy; doctrine; and, operations (which was further broken down into planning and execution). For each area, they identified the appropriate decision makers, the decisions they need to make, the OR capabilities available to assist them in making those decisions, the deficiencies in those capabilities, and what needs to be done to correct those deficiencies. The working group generated seventeen specific recommendations, which can be grouped into three basic categories:

1. Testing, leading to additional and improved data.
2. Support for development of new methodologies and improvements to existing ones.
3. Improved knowledge of the phenomenology of battle.

Among their recommended actions was a future MORS workshop focused on the topic of application of force in JUO, as they found the quantity and magnitude of issues needing to be addressed more than could be adequately discussed in a day and a half. They also identified the need for establishing a strong urban warfare proponent, and they called for better communication within the community on this topic. Finally, they suggested that MORS consider re-establishing a working group for the MORS Symposium on the topic of urban warfare.

Mobility and Maneuver was the topic of Working Group 6, headed by the team of Dr. Niki Deliman and CPT Scott Crino, US Army. After establishing a definition for mobility and maneuver in an urban environment, the seventeen members of this group proceeded to identify some unique considerations about that environment with an effect on movement. These ranged from street patterns to close spacing of buildings to the presence of civilians to the multi-dimensional aspects of the terrain. The group then identified five areas where OR could assist decision makers faced with these difficulties:

1. Help define new measures of outcome, effectiveness and performance for the urban environment.
2. Develop knowledge, algorithms and data to support models and simulations.
3. Identify and develop methods to build effects-based models from physics-based models.
4. Define the features and attributes that make up the urban environment and support M&S of that environment.
5. Help establish an environment to define the operational requirements for future combat and combat support systems.

The group identified 25 shortfalls in the community's ability to make these contributions — some selected examples of which include models of group cognitive behaviors, models for congestion effects on mobility, models for rubble and its effect on mobility, and methods for generating geo-typical and geo-specific building interiors with appropriate structural characteristics. The groups recommendations to improve analysis of JUO mobility and maneuver include:

1. Establish a process for better coordination among stakeholders
2. Raise the priority for joint urban operations resourcing (e.g., establishing joint professional military education on the subject of urban warfare for leaders at all levels).

3. Adequately resource urban model and database improvements for both physics-based and effects-based models.
4. Test, train and experiment in real and realistic urban environments.
5. Build sufficient facilities for JTF maneuvering.

Support and Sustainment was the topic addressed by Greg Keethler, who stood in as chair of the working group when events following the September 11 attack prevented both the chair and co-chair from attending. The group of nine placed a heavy emphasis on medical support and sustainment issues by virtue of its membership. The group identified areas of support and sustainment that are particularly affected in urban warfare:

- Consumption of expendables (food, water, ammunition, etc) is typically higher, and shortages are less tolerable.
- The supply lines of communication are restricted and cumbersome.
- There is a need to replace equipment rather than repairing it in place.
- Protection of casualties and prisoners of war is more difficult.
- Medical evacuation is tougher and usually consumes combat power.
- Historically, the casualty rates are higher, the wounded are more dispersed and more difficult for medics to access.
- Sanitation is frequently problematical, there is a high probability of exposure to hazardous substances, and exposure to disease can be quite high.
- The dispersed nature of fighting makes real-time logistics needs assessment difficult.
- Normal transportation modes are highly vulnerable in urban terrain.
- There are frequently multiple non-governmental agencies, international governmental agencies, and private volunteer organizations trying to run their own logistics operations at the same time.

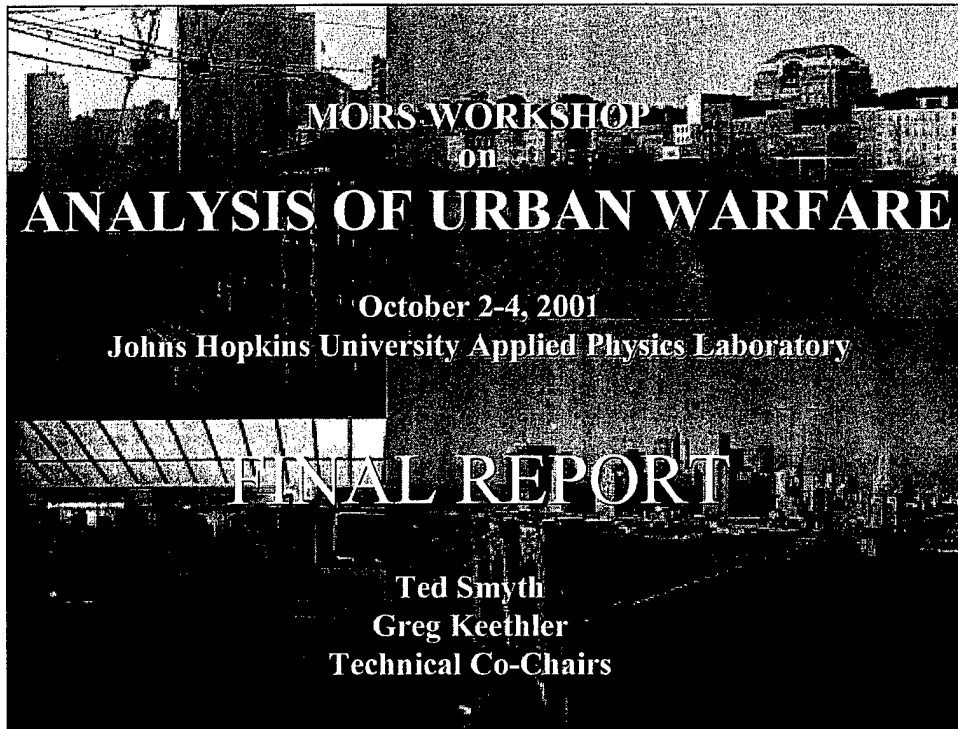
Decisions made by planners are based on assumptions about all of these factors (casualty rates, consumption rates, etc) as well as fundamental aspects of support and sustainment such as establishing supply routes, distribution points, casualty evacuation protocols, surgical unit locations, host nation support, and other logistic obligations (treatment of civilian casualties, supplies for NGO's, IGO's, PVO's, and coalition forces, etc). The group assessed that the OR community can take the following actions toward addressing these issues: ensure models and simulations consider the implications of support and sustainment when applied to urban warfare; help ensure support and sustainment assumptions and algorithms are verified and validated with regard to urban modeling and simulation; conduct a systematic study of historical data in the context of changed conditions we face today; conduct a systematic review (i.e., meta-analysis) of existing studies to perhaps reveal new insights; for future analysis, help ensure appropriate data collection during actual urban operations, training exercises, ACTD's, experiments, tests, etc.; and help decision makers develop and identify key MOEs with regard to support and sustainment in urban warfare. Overall, the group assessed that the OR community's capabilities to accomplish these actions is quite good, but support and sustainment issues have not been a particular focus heretofore in the examination of joint urban operations. What is needed is an integration of existing or within-reach capabilities to focus on JUO

support and sustainment; because in ways different than in other environments, support and sustainment can be the limiting factor for mission success in urban warfare.

Synthesis

The Synthesis Working Group, Co-Chaired by Bob McIntyre and Dr. Bob Sheldon, past MORS President, assigned members to observe all the other groups with an eye toward identifying the larger, cross-cutting observations and findings. Six such overarching themes emerged from the working group findings. First, the working groups fairly consistently identified that as a whole, both the operational and analytical communities need a better understanding of the fundamental characteristics and phenomenologies associated with joint urban operations. Moreover, the working groups highlighted the need for better identification, collection, fusion, availability and management of data related to JUOs. Closely related to this finding is the need for development of more relevant and widely accepted MOEs, MOPs and other metrics used in assessing and analyzing JUO. This, in turn, leads to the need for developing better analytical methodologies, tools and techniques. Several working groups also recommended conducting some systematic and comprehensive analyses of past and current urban operations, exercises, ACTD's, operational tests, and the like. Finally, there was broad consensus among the working groups on the need for increased interaction, communication, and coordination among the joint urban operations analysis community, and more resources are needed to provide the wherewithal for need analysis of such operations.

With 141 participants, attendance at the workshop was significantly above average for a MORS special meeting. Overall, critiques from attendees gave the workshop high marks. In particular, participants were heartened to see that MORS is focusing attention, once again, on urban warfare. A briefing based on this report was presented to the Military Operations Research Society Sponsors and at the 70th MORSS at Fort Leavenworth KS, in June 2002.



Planning for this Workshop began in January – February 2001. Motivation for the Workshop was generated by the following beliefs:

- Future warfare will probably involve combat in the extremely complex urban environment.
- Future urban operations will not consist only of a ground combat operation but will most probably be Joint and involve inter-agency dependencies and Coalition Forces.
- Each of the military services, DoD and The Joint Staff need to consider all potential warfighting needs (force structure, force sizing, training and acquisition needs) in light of the potential for future Joint urban operations.

Analysis of Urban Warfare Overview



Analysis of Urban Warfare Workshop

- Organizational Info
- Focus
- Goals and Objectives
- Plenary Speakers
- Working Groups
- Working Group Findings
- Synthesis
- Wrap-up

This slide provides the agenda for this briefing on the workshop.

Organizational Information



Analysis of Urban Warfare Workshop

- **Who:** Mike Bauman, General Program Chair
Director, TRADOC Analysis Center
- **What:** Analysis of Urban Warfare Workshop
- **Where:** Johns Hopkins University/Applied
Physics Lab
- **When:** 2-4 October 2001
- **Attendance:** 141
- **International Representation:** US, Australia,
Israel, The Netherlands, Sweden and UK

The Proponent for the Workshop was Mike Bauman, Director, TRADOC Analysis Center.

The Workshop was held at JHU/APL shortly after the events of 9/11/01, when air travel was very difficult. Although the Workshop suffered some cancellations of both attendees and speakers, MORS was extremely pleased to see the numbers of participants who were able to attend. The Society was particularly pleased with Allied representation. Allied attendance had been anticipated and was encouraged; as a result the Workshop was purposely structured and conducted at an UNCLASSIFIED level to permit their attendance.

Focus



Analysis of Urban Warfare Workshop

- On Joint urban combat operations:
(Reference: Draft Joint Pub 3-06, "Doctrine for Joint Urban Operations-Preliminary Coordination Draft, 17 April 2001)
 - Tactical
 - Operational
 - Strategic
- Consider:
 - Humanitarian
 - Extraction
 - Peacemaking/peacekeeping
 - Smaller Scale Contingencies (SSC)

To provide a common baseline for the Workshop, the MORS Joint Staff Sponsor helped us gain early access to DRAFT Joint Staff Publication 3-06. In our view this DRAFT publication is an excellent document and provides significant guidance relative to the conduct of Joint urban operations. The publication also contains numerous historical vignettes and addresses the full spectrum of conflict: tactical/operational/strategic levels of combat. In addition the publication considers a variety of potential Joint urban operations:

- Humanitarian assistance;
- Personnel Extraction (Non-combatant Extraction Operations [NEO]);
- Peace related operations; and,
- SSC.

Goals and Objectives



Analysis of Urban Warfare Workshop

- Gain an understanding of the basic characteristics, challenges, and decision needs of current and anticipated Joint urban combat operations.
- Assess the needs of decision makers at all levels.
- Perform an assessment of our knowledge, methods and existing data, relevant to Joint urban combat operations.
- Provide a list of candidate actions to acquire relevant knowledge and data and to develop appropriate analytical tools and methodologies.

The Goals and Objectives of the Workshop are shown on this slide. The first two objectives were purposely addressed on Day 1, which was designed to provide both historical perspectives on urban operations and to gain insights from “warfighters and operators.”

Objectives three and four were addressed on Days 2 and 3, which were designed to address and assess today’s capabilities of the analytical community to analyze Joint urban operations and to recommend actions for the analytical community to pursue.

Plenary Speakers



Analysis of Urban Warfare Workshop

Keynote speaker: Major General John Barry, USAF

- Dr. Wick Murray, IDA
- Dr. Russ Glenn, RAND
- MG Carl Ernst, US Army (Ret)
- Ambassador Bill Farrand
- LtCol Colin Beadon, RM
- Major Shane Gabriel, Australia

An outstanding collection of speakers addressed a plenary session of the Workshop on Day 1.

The Keynote Speaker, MG Barry, USAF, Director of Strategic Plans, Air Staff, noted the urban nature of the 9/11/01 attacks as well as ongoing violence in the middle east. MG Barry specifically challenged the Workshop participants to move beyond a focus simply on tactical level, ground operations. He challenged the participants to consider the multi dimensional urban battlespace and to think in a Joint context.

Drs Murray and Glenn teamed up to provide a focused recap of 20th century urban operations and identified unique characteristics/challenges that the urban environment presents.

MG Earnst, USA (Ret) recounted his experiences as CDR, JTF Somalia. He specifically focused on restrictive Rules Of Engagements (ROEs), the continual presence of the global media, the intermingling of civilian/threat forces, and the ever-changing urban landscape.

Ambassador Bob Farrand, the former Supervisor of the urban center of Brcko in Bosnia, spoke to the importance of the necessary operational/analytical interaction required of military/civilian players in urban operations.

LtCol Beadon, Royal Marines, a veteran of combat in Northern Ireland discussed the use of terrorist tactics in urban areas.

Maj Shane Gabriel, Australian Army, shared recent Australian experiences in East Timor and emphasized the need for more extensive training and training support tools oriented on urban combat operations.

Plenary Speakers (Cont.)



Analysis of Urban Warfare Workshop

- COL Bill Huff, US Army (Ret)
- Nick Warr, Author
- Dr. Darryl P. Greenwood, MIT/LL
- Dr. Alfred G. Brandstein, MCCDC
- LTC (P) Joseph Anderson

COL Huff, USA(Ret), a former battalion commander in Operation JUST CAUSE (Panama, 1989), cited the manpower intensity required of the urban fight as well as the complications that arise with civilians. Somewhat ironically, COL Huff, a former analyst at SOUTHCOM prior to JUST CAUSE, had advocated the digitization of Panama City maps and the use of the JANUS Simulation to investigate critical time/distance relationships in the operational plan that was used.

Nick Warr, author of *Phase Line Green, Hue City*, emphasized the problems attendant to the imposition of restrictions on the use of fire support assets in the early days of that battle, casualty evacuation problems and their impact, as well as the criticality of eliminating enemy C2 capabilities.

Dr. Greenwood, MIT/Lincoln Laboratory, served as a member of the Summer 2001 Air Force Summer Study, "Sensing Difficult Targets." The Study highlighted the impact of restricted lines of sight, the difficulties in differentiating friendlies/unfriendlies and the actively hostile. The Study also called for better sensing/fusing architectures and improved targeting, Battle Damage Assessment (BDA) and Command and Control (C2) capabilities.

Dr. Brandstein questioned many of today's analytical capabilities and strongly urged the analytical community to further investigate the "New Sciences" in the hope of better understanding the non-linearity of warfare.

Finally, LTC(P) Anderson, USA, contrasted his personal experiences in Panama and Kosovo and strongly urged the development of better decision making tools such as enroute mission planning and rehearsal capabilities.

Working Groups



Analysis of Urban Warfare Workshop

- **Force Packaging and Projection:** Gene Visco, FS
- **Intelligence, Surveillance and Reconnaissance:** Corinne Wallshein
- **Command, Control and Communications:** Steve Upton and Scott Bamonte
- **Mobility/Maneuver:** Dr. Niki Deliman and CPT Scott Crino
- **Application of Force:** Mike Carothers, Vic Middleton and John Galloway
- **Force Protection:** Dale Malabarba
- **Support and Sustainment:** Greg Keethler
- **Synthesis/Integration:** Bob McIntyre and Bob Sheldon

The Workshop participants included a wealth of MORS talent. Working Group leadership responsibilities were assumed by:

- Gene Visco, FS and LTC James O'Sullivan, UK
- Corrine Wallshein, USAF analyst
- Steve Upton, MITRE and a former Marine analyst
- Dr. Niki Deliman and CPT Scott Crino, USA, formerly of TRAC Monterey and now assigned to the Command and General Staff School (CGSC) Ft Leavenworth, KS
- Mike Carothers and a team from the US Army's Aberdeen Proving Ground
- Dale Malabarba of the Army's Natick Laboratory and Solider Center
- Greg Keethler, a former USAF analyst and now with the USAF Space Command
- Bob McIntyre and Dr. Bob Sheldon, both eminent MORSians

Working Group Findings

A report of the individual Working Group findings follows.

Force Packaging and Projection



Analysis of Urban Warfare Workshop

- Need:
 - Capability to support enhanced cross-government planning, organization and capability
 - Improved data management to enhance speed of planning and enhanced IPB/PBA
 - Better training and campaign analysis tools
 - Ability to evaluate future scenario force requirements and structures

The Force Packaging and Projection Group began its investigation by attempting to determine the broad, yet unique requirements, of a generic Joint Force, directed to deploy to an urban environment. The Group determined that factors that impact force packaging and projection include:

- Identification of the specific operational need.
- Knowledge of the status of airfields, ports, roadways and the availability of lift assets.
- An awareness of the potential increased need for humanitarian support.
- An awareness and understanding that the threat may purposely draw the Joint force into urban areas to minimize its technological impact.

Findings of the Group included the following major points:

- The tools and processes to effectively/efficiently support cross government planning, organization, and coordination are lacking.
- A clear need exists to improve the content of, access to, and management of data, specifically with respect to planning, Intelligence Preparation of the Battlefield (IPB) and Predictive Battlespace Awareness (PBA).
- The need for better training and campaign analysis tools in support of operational and logistics planners.
- A capability to better examine alternative force requirements, size and structure.

Intelligence, Surveillance and Reconnaissance



Analysis of Urban Warfare Workshop

- Need:
 - Increased community focus on Joint Urban Warfare ISR issues
 - Better understanding of ISR requirements in JUO
 - Better metrics definition
 - Better tools and techniques
 - Better data and data fusion

This Group, led by Corrine Wallshein, served in many ways to reinforce the observations of Dr. Greenwood and the previously cited USAF Summer Study. Specific comments from the Group included:

- There are significant Intelligence, Surveillance and Reconnaissance (ISR) deficiencies in the Joint urban environment; moreover, this issue deserves much more focused attention not just within DoD but within MORS Working Groups, specifically, WG 6 (C4ISR), WG 29 (M&S and Wargaming) and WG 32 (Social Sciences). These Working Groups should address the ISR issue and also examine the psychology of Joint urban operations in terms of group behavior, economics and political science.
- As analysts, the MORS community needs to better understand ISR requirements in the context of the Joint urban environment.
- Improved metrics definitions are required, as are better tools and techniques and decision support tools for IPB and PBA.
- Improved data, data access, and data fusion capabilities are most certainly required.

Command, Control and Communications



Analysis of Urban Warfare Workshop

- Need:
 - Improved MOE's (military and non-military)
 - Evaluate/develop tools for assessing/modeling JUO
 - Identify data shortfalls
 - Conduct comprehensive analyses of past urban operations

This Group was led by Steve Upton. The Group concluded that:

- Urban terrain magnifies the difficulties of every aspect of a modern military operation.
- A need exists to improve Measures Of Effectiveness (MOEs) and analytical tools for assessing and modeling Command, Control and Communications (C3) in Joint urban operations.
- Multi-dimensional modeling of the urban environment and battlespace is required in order to assess the impact on C3 capabilities and requirements, particularly with respect to modeling and understanding the nuances related to C2 such as the impact of influencing behavior of individuals, groups and organizations.
- There is a distinct lack of data relevant to C3 in Joint urban operations and as such the Group recommends comprehensive analyses of past urban operations.

Force Protection



Analysis of Urban Warfare Workshop

- Need:
 - Better data and improved data availability (central repository)
 - Improved characterization of urban environments
 - Better linkage between test and OR communities
 - New and improved analytical methodologies for a knowledge-based force
 - Better understanding of urban warfare phenomenology

The Force Protection Working Group was led by Dale Malabarba of the US Army's Laboratory and Solider Center at Natick, MA. Please note that a number of recurrent themes are beginning to emerge from the working groups.

The Force Protection Working Group also perceived a lack of relevant data and cited deficiencies in the effective management of data relevant to force protection. In this regard the Working Group offered, by means of an example, that DoD should establish a trauma registry to support operational, medical casualty research.

The Working Group also suggested that linkage be established between the test and analytical communities in order to better capture and use test data.

The Group also believed that a better understanding of urban warfare phenomenology is required by analysts. Such improved understanding may be gained through closer analytical collaboration with Allies (the UK and Israel), who have more recent involvement in urban operations.

Application of Force



Analysis of Urban Warfare Workshop

- Need:
 - Testing leading to improved data
 - Support for development of new methodologies and improvements to existing ones
 - Improved knowledge of the phenomenology of battle
 - Future MORS Workshop focused on application of force in JUO
 - Strong JUO Analysis Proponent
 - Improved communication in the community
 - Re-establish JUO MORSS Working Group

Mike Carothers from the US Army's Aberdeen Proving Ground served as the lead of the Application of Force Working Group.

The Group began their work by defining the term Application of Force as the application of force employment of both lethal and non lethal weapons.

With this definition the Group then proceeded to observe that most of the existent data is old and that testing and the capture of new additional data from operations, exercises and tests are required.

The Group strongly recommended that a future MORS workshop, focused solely on the Application of Force in an urban environment, be held.

The Group also identified the need for a strong Joint urban operation analytical proponent within DoD and suggested the re-establishment of a Joint urban operation MORS Working Group at the MORS Symposium.

Mobility



Analysis of Urban Warfare Workshop

- Need:
 - Define new measures of outcome, effectiveness and performance in JUO
 - Develop knowledge, algorithms and data to support models and simulations
 - Develop methods to evolve effects-based models from physics-based models
 - Define key features comprising the urban environment and support M&S of those features
 - Better coordination/communication among JUO analysts
 - More resources for JUO analysis

Dr. Niki Deliman and CPT Scott Crino, US Army, served as the co-leads of the Mobility Working Group.

The Group began its efforts with an examination of the multi-dimensional aspects of urban terrain and focused on discussions of street patterns, spacing and the size of buildings and other structures.

The Group strongly believes that the analytical community should carefully re-examine traditional mobility related MOEs and Measures Of Performance (MOPs) in a Joint urban context. The Group also recommended that attention be focused on the development of better models and techniques to assess the effects of congestion on mobility and to assess the impact of rubble on mobility.

The Group also suggested that key features of the urban environment require better definition and identified the need for generating geo-typical and geo-specific building interiors/exterior with appropriate structural features. The Group also recommended that consideration should be given to the development of a complete urban environment model that includes the capability to address issues relative to airspace, roof tops, surface and subsurface infrastructure.

Finally, this Group identified the need for more analytical attention and resources to be devoted to support the analysis of Joint urban operations.

Support and Sustainment



Analysis of Urban Warfare Workshop

- Need:
 - Ensure models and tools consider the implications of support and sustainment when applied to JUO
 - Conduct a systematic study of historical data in the context of changed conditions
 - Conduct a systematic review recent/current studies with a view to integrate/synthesize results
 - Collect relevant data during actual urban operations, training exercises, ACTD's, etc.
 - Assist in identifying and developing key MOEs

Greg Keethler of the USAF Space Command ably served as the lead of this Working Group, when it was learned that the intended lead would not be able to participate in the Workshop due to the events of 9/11/01.

The composition of the Group lead to heavy emphasis and detailed discussions on medical support and sustainment issues. As a result the Group recognized the impact of urban warfare on the consumption of expendables, specifically food, water and ammunition. In the urban environment consumption of these expendables is typically higher and shortages much less tolerable.

Group discussions also seemingly confirmed the thesis of one of our Plenary speakers, Nick Warr, that casualty evacuation is typically more difficult and manpower intensive, due in part by the fact that casualties are historically higher and resupply and maintenance more difficult in urban operations.

The Group went on to identify the following analytical actions:

- Ensure that M&S efforts fully consider and include support and sustainment organizations, capabilities and limitations.
- Whereas decisions made by today's planners basically use old WWII, Korea and Vietnam era data for sustainment needs and rates, more current data is required. Analytical efforts should also be made to determine whether extrapolation of old data is possible for use today.
- In addition a systematic review of recent/current studies pertaining to support and sustainment is required .
- The collection and analysis of data from relevant operations, exercise and experiments is needed.
- The analytical community should work to identify, develop and refine appropriate support and sustainment MOEs for use in Joint urban operations.

Synthesis



Analysis of Urban Warfare Workshop

- Need:
 - Improved understanding of fundamental JUO characteristics and phenomenologies
 - Better data identification, collection, fusion, availability and management
 - Development of more relevant and accepted MOPs, MOEs and other metrics for JUO
 - Development of better analytical methodologies, tools and techniques for JUO
 - Conduct systematic, comprehensive analyses of past and current urban operations, exercises, ACTD's, etc.
 - Increased interaction/communication/ coordination as well as resourcing for the JUO analytical community

The Synthesis Group effort was lead by Bob McIntyre and Dr. Bob Sheldon, MORS Past President. The Group concluded that:

- There needs to be much better awareness and understanding of Joint urban operational needs within the analytical community.
- A major problem exists with respect to data; much of the data that exists today to support the analysis of Joint urban operations is either old, unknown, or is poorly managed.
- On a related issue, strong consideration should be given to conduct a comprehensive review and either refine or, if needed, develop new metrics to support the analysis of Joint urban operations.
- There exists a clear need for better analytical tools and techniques to better replicate urban terrain and the analysis of Joint urban operations.
- Strong consideration should be given to conduct extensive analyses of past/recent Joint urban operations, exercises and applicable experiments.
- Finally, it appears that much of the current analytical effort that is addressing Joint urban operations is fragmented; much improved communication and coordination is required within the analytical community in order to successfully address the significant challenge presented by Joint urban operations.

Wrap-Up



Analysis of Urban Warfare Workshop

- Well-attended
- Extensive slate of quality, relevant speakers
- Excellent workshop staff
- Positive feedback received
- Renewed interest in analysis of JUO
- Bottom line: Successful Workshop!

In retrospect, the Analysis of Urban Workshop was very successful. One hundred and forty one participants in an event that closely followed the attacks of 9/11/01, at a time when air travel was difficult, was remarkable. The Workshop was most fortunate in having attracted a slate of speakers and Working Group leaders who were without equal in their respective fields.

Considerable positive feedback was received and the Workshop served to regenerate significant interest in the analysis of Joint urban operations. However, this Workshop can only be considered a start. Considerable work and numerous challenges await the analytical community as it begins to understand the complexities of the urban environment and its impact on Joint operations.

MORS Workshop
Analysis Of Urban Warfare
October 2-4, 2001
Johns Hopkins University
Applied Physics Laboratory

Appendix A — Acronyms

ACTD	Advanced Concept Technology Demonstration
BDA	Battle Damage Assessment
C2	Command and Control
C3	Command, Control and Communications
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CALL	Center for Army Lessons Learned
CGSC	Command and General Staff School
CONOPS	COnccepts of OPERATIONs
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
EBO	Effects Based Operations
FS	Fellow of the Society (MORS)
GIRH	Generic Information Requirements Handbook
IGO	Inter-Governmental Organization
IPB	Intelligence Preparation of the Battlefield
ISR	Intelligence, Surveillance and Reconnaissance
JHU/APL	Johns Hopkins University Applied Physics Lab
JTF	Joint Task Force
JULLS	Joint Universal Lessons Learned System
JUO	Joint Urban Operations
LC2IEDM	Land C2 Information Exchange Data Model
M&S	Modeling and Simulation
MCCDC	Marine Corps Combat Development Command
METT-TC	Mission/Enemy/Terrain/Troops/Time/Civilians
MOE	Measures of Effectiveness
MOOTW	Military Operations Other Than War
MOP	Measures of Performance
MORS	Military Operations Research Society
NEO	Non-combatant Extraction Operations
NGO	Non Governmental Organizations
OR	Operations Research
PBA	Predictive Battlespace Awareness
PM/PK	Peace Making – Peace Keeping
PVO	Private Voluntary Organization
ROE	Rules Of Engagement
SAB	Scientific Advisory Board (Air Force)

SOUTHCOM	Southern Command
SSC	Small Scale Contingencies
TRAC	TRADOC Analysis Center
TRADOC	US Army Training and Doctrine Command
TTP	Tactics, Techniques and Procedures
TTP	Tactics, Techniques and Procedures
UAV	Unmanned Aerial Vehicles
UK	United Kingdom
UN	United Nations
US	United States
USA	United States Army
USAF	United States Air Force
USECT	Understand, Shape, Engage, Consolidate and Transition
USMTF	United States Message Text Format

**Terms of Reference
MORS Workshop**

Analysis of Urban Warfare

2-4 October 2001
Johns Hopkins University Applied Physics Laboratory

1. Background

The importance and relevance of cities to future military operations in which the United States may commit its forces has been the subject of considerable debate. Some argue that combat in cities must be avoided at all costs while others suggest that we will be unable to avoid urban deployments short of war and even full-scale city combat.

While it is impossible to predict with any degree of accuracy the type or location of future 21st century conflicts, it must be recognized that our military history is punctuated with the names of cities – Seoul, Saigon, Hue City, Panama City, Kuwait City, Mogadishu, Port-au-Prince, and Sarajevo. Images of dead and wounded U.S. military personnel in urban areas have appeared on television screens in marked contrast to the almost sterile videos of precision-guided munitions finding their mark against tanks arrayed in open deserts or entering the windows of enemy buildings.

Unfortunately, if demographers and political strategists are correct, the reality is that many, if not most, of the military operations of this century will be conducted in and around large urban areas. The United Nations predicts that by 2025, 60 percent of the world's population will be found in urban areas. Moreover, it is already a fact that urban sprawl impedes many militarily important operational lines, as evidenced by Korea's western corridor, the German Ruhr, the Shanghai-Beijing corridor, the Ganges valley and the Boston-Washington corridor. In addition, many cities are now too large to permit evacuation and offer no sanctuary for displaced residents, as is apparent in Singapore, Hong Kong, Calcutta, Tokyo, Seoul, Lagos, Mexico City, and Los Angeles.

Recognizing at least the potential for the future commitment of U.S. military power into urban areas, the House Armed Services Committee, has recently directed the Secretary of Defense to designate an appropriate executive agent with the authority to develop and coordinate a master plan for a DoD wide strategy, with milestones, for improving service and joint capabilities to conduct military operations in urban environments.

The rationale behind such guidance is clear. Future joint urban operations will be planned and conducted across the entire range of military operations from the tactical to the strategic levels. Joint urban operations may be part of a campaign or compose the entire campaign itself, and may well require the synchronization of all instruments of national power (diplomatic, economic, military, and informational) to achieve strategic, operational, and tactical objectives. These varied forms of joint operations will be focused on a topographical

complex and its adjacent natural terrain where manmade construction and the density of noncombatants are the dominant features.

Such an urban environment poses significant and unique challenges to future military operations. Combat operations associated with this environment will be multi-dimensional in character. Combat may encompass operations at street level, in and from the airspace or beyond it, on roofs and in the upper stories of buildings, and below street level in sewer systems, subways, and other underground structures, and in cyberspace. These broad-ranging features of the urban environment significantly impact the organization and employment of joint and coalition forces; challenge our command, control, and communications capabilities; put a premium on accurate and timely intelligence, surveillance, and reconnaissance; impact our weapons employment options; degrade our ability to maneuver; and affect our overall approach to achieving strategic and tactical objectives in the presence of large numbers of civilians in the battle area. Hence, our ability to assess and analyze the nature of joint operations is essential if we are to assist decision-makers in preparing for and conducting joint urban operations.

Although urban warfare has served as the subject of extensive analysis over the years, most practitioners of operations research agree that the analytical tools and methods available to quantitatively understand and evaluate the demands of joint urban operations are severely lacking in the context of new warfighting concepts, operations, and systems. Consequently, the complex analytical challenges posed by future joint urban operations, across the spectrum of conflict, warrant the immediate attention of the military operations research community.

2.0 Goals, Objectives, and Scope

2.1 Goals

The Workshop has several goals. First, the Workshop will provide a comprehensive and improved understanding of the challenges posed by joint operations in the urban environment. Secondly, the Workshop will assess the needs and challenges faced by decision-makers regarding joint urban operations. Finally, the Workshop will assess the military operations research community's current and projected capabilities to support these needs in view of current and projected warfighting concepts, operations, and systems.

The primary focus of the Workshop is to support the military analytical community's ability to assess the conduct of urban operations by U.S. joint forces in support of senior decision-makers. However, participation by analysts from other U.S. federal agencies and by U.S. Allies is encouraged and will provide expanded opportunities for the mutual exchange of analytical approaches, data, and tools in support of the analyses of urban operations.

2.2 Objectives

In order to achieve a better understanding of the operational and analytical challenges of urban operations across the spectrum of conflict, the Workshop will pursue the following objectives:

- Gain an understanding of the basic characteristics, challenges, and decision needs of current and anticipated joint urban combat operations
- Assess the needs of decision-makers
- Perform an assessment of our knowledge, methods, and existing data, relevant to joint urban combat operations
- Provide a list of candidate actions necessary to acquire relevant knowledge and data and to develop appropriate analytical tools and methodologies in order to more effectively analyze and assess future warfighting concepts, operations, forces, and systems employed in an urban environment

2.3 Scope

The scope is confined to operations research capabilities and shortfalls for joint urban combat operations, spanning the spectrum of conflict from major theater warfare to small-scale combat. The discussions will focus upon analytic support for the following broad topic areas:

- Force packaging and projection
- Intelligence, surveillance, and reconnaissance
- Command, control, and communications
- Mobility/maneuver
- Application of force (lethal and non-lethal effects)
- Force protection
- Support and sustainment

3.0 Approach

3.1 Overview

The three day Workshop will be conducted to identify the critical issues in joint urban combat operations and to assess the military operations research community's capabilities and requirements to address these critical issues. On the first day, participants will convene in a plenary session for a broad discussion of the challenges inherent in urban warfare and an historical overview of combat operations in an urban environment. A keynote speaker of national military prominence and with urban combat experience, General Tony Zinni, USMC(Ret), former CINC CENTCOM, will open the workshop and will define critical issues in urban combat operations as well as challenge the audience to actively address these issues from an analytical perspective. Subsequent speakers and panel members, representing both U.S. and Allied experiences in urban warfare, will address urban combat operations from both an historical perspective as well as from a warfighter's view. Additionally, recent

urban warfare analytical initiatives and findings will be presented. Collectively, these speakers will identify and provide a basic understanding of the key issues involved in urban warfare in sufficient detail to support detailed, focused discussions during the remainder of the workshop.

The second and third day will be conducted as a Workshop. The Workshop phase is intended to address the analytical challenges of urban combat operations across the spectrum of conflict, ranging from major theater warfare to small-scale contingencies. During this phase, participants will be divided into working groups to address the objectives listed in paragraph 2.2. Working groups will be formed to address the analytical tools, methodologies, and data required for analysis of the topic areas identified in paragraph 2.3.

On the afternoon of day three, participants will gather in plenary session to receive reports and recommendations from each of the working groups.

3.2 Working Groups

Each of the first seven working groups will address analytical capabilities and requirements within each of the focused topic areas. Joint urban combat operations across the spectrum of conflict, ranging from major theater warfare to small scale contingencies, will be addressed by each working group. In addition, each group is requested to also address analytic issues and implications related to any cooperation and/or interoperability required between military and civilian components in the conduct of these operations.

Each group will have two co-chairs. One co-chair will provide subject matter expertise and analytical experience within the topic area while the other co-chair will possess MORS familiarity and experience. As required and at the discretion of working group co-chairs, smaller sub-working groups may be formed to address more specific issues within the topic area of the working group. Working group co-chairs are encouraged to maximize opportunities for discussion of focused topics and to minimize the number and length of formal presentations within individual working groups. To facilitate the development of working group reports, working group co-chairs are also encouraged to designate one or more working group participants as recorders of the working group proceedings

The eighth working group, synthesis, will be composed of a small group of individuals, selected by the Program Chair and Organizational Committee. The synthesis working group will be charged to operate independently to provide the Program Chair and other seven working group co-chairs with an independent and impartial assessment of the working groups' discussion, progress, findings, and recommendations.

4.0 Products

4.1 Reports and Briefings

- Executive Summary and After-Action Briefing to MORS Sponsors (S: 4 Nov '01)
- Final Report to MORS Office (S: 4 Jan'02)

- 70th MORSS Briefing (S:15 Jun'02)

4.2 News Articles

- *PHALANX* articles announcing the Urban Warfare Workshop (S: 15 Jun'01; 31 July '01)
- *PHALANX* article summarizing the Urban Warfare Workshop (S:15 Jan'02)

5.0 Administration

5.1 **Dates:** 2-4 October 2001

5.2 **Location:** Johns Hopkins University Applied Physics Laboratory, Laurel, MD

5.3 **Classification:** Unclassified

5.4 **General Program Chair:** Director, US Army TRADOC Analysis Center, Ft Leavenworth, KS

5.5 **Technical Program Chair:** Ted Smyth, Johns Hopkins University Applied Physics Laboratory, Laurel, MD

Technical Program Co-Chair: Greg Keethler, Applied Research Associates, Inc., Albuquerque, NM

Working Group Chair(s):

- **Force packaging and projection:** Peter Cherry, Vector Research, Ann Arbor, MI
- **Intelligence, surveillance, and reconnaissance:** Corrine Wallshein, US Air Force, The Pentagon, Washington, DC and Dave Dilege, Adroit Systems, Inc.
- **Command, control, and communications:** Steve Upton, MITRE, Tampa, FL and Scott Bamonte, MITRE
- **Mobility/maneuver:** Niki Deliman, USACE ERDC, Vicksburg, MS and CPT Scott Crino, USArmy, TRADOC Analysis Center, Monterey, CA
- **Application of force (lethal and non-lethal effects):** Mike Carothers, US AMSAA, Aberdeen Proving Ground, MD, Vic Middleton, Middleton Associates and John Galloway, TRAC-WSMR
- **Force protection:** Dale Malabarba, US Army Natick Soldier Center, Natick, MA and Hank Kinnison, The Wexford Group
- **Support and sustainment:** Mike Mellor, Teledyne Brown Engineering, Arlington, VA and LCDR Joe DaCorta, MCCDC
- **Synthesis:** Bob McIntyre, Simulation Technologies, Inc., Raleigh, NC and Bob Sheldon, Emergent IT, Vienna, VA

5.6 Registration Fees:

Days 1-3 (Complete Workshop):

\$200.00 U.S. Federal Government Employees
\$400.00 Others

Day 1 (Plenary Session) Only:

\$100.00 U.S. Federal Government Employees
\$200.00 Others

5.7 Tentative Agenda:

DAY 1: Plenary Session

Registration

Call to Order/Welcome

Technical Program Chair – Mr Ted Smyth
MORS President – Mr Tom Allen
General Program Chair – Mr Mike Bauman

Workshop Agenda Overview

Keynote Presentation – TBA

Historical Context Speakers – Dr Williamson Murray, Institute for Defense Analysis and Mr Frank Hoffman, former member of the US Commission on National Security/21st Century

Luncheon Speaker - TBD

Military “Warfighter” Panel:

Ambassador William Farrand, Bosnia
LtCol Colin Beadon, RM, Northern Ireland
COL William Huff, US Army (Ret), former Commander in Panama, 1989
Mr Nick Warr, Operation Hue City participant and author of *Phase Line Green*
Major Shane Gabriel, Australia

Introduction of Working Groups

Mixer

DAY 2: Working Group Sessions

Registration

Morning Working Group Sessions

Luncheon Speakers – Major General John Barry, USAF, Director of Strategic Planning, HQ, USAF and Dr Darryl Greenwood, MIT Lincoln Labs

Afternoon Working Group Sessions

Presentation on US Army Summer Science Board Study on “Dismounted Operations in Complex Terrain”

Day 3: Working Group/Plenary Sessions

Registration

Morning Working Group Sessions

Luncheon Speaker – LTC(P) Joseph Anderson, US Army, Instructor, US Navy War College

Plenary Session: Individual Working Groups Reports

Program Chair/Organizational Committee “Hot Wash Up”

Analysis of Urban Warfare

2 - 4 October 2001

Johns Hopkins University Applied Physics Laboratory

DAY 1: Plenary Session

- 0700 Registration
- 0830 Call to Order/Welcome
- Technical Program Chair
 - MORS President
 - General Program Chair
- Workshop Agenda Overview
- 0845 Keynote Presentation: **TBA**
- 0945 Break
- 1000 Historical Context Speakers: Dr. **Williamson Murray**, Institute for Defense Analysis (IDA)
Mr. **Frank Hoffman**, former member of the US Commission on National Security/21st Century
- 1200 Luncheon Speaker: **TBD**
- 1330 Military "Warfighter"/Panel: Ambassador **William Farrand**, Bosnia
LtCol **Colin Beadon**, RM, Northern Ireland
COL **William Huff**, USA, (Ret), former Commander in Panama, 1989
Mr. **Nick Warr**, Operation Hue City participant and author of *Phase Line Green*
Major **Shane Gabriel**, Australia
- 1530 Break
- 1545 Introduction of Working Groups
- 1700 Mixer

DAY 2: Working Group Sessions

- 0700 Registration
- 0800 Morning Working Group Sessions
- 1200 Luncheon Speakers: **Major General John Barry**, USAF, Director of Strategic Planning, HQ USAF
Dr. Darryl Greenwood, MIT Lincoln Labs
- 1300 Afternoon Working Group Sessions
- 1600 Presentation: US Army Summer Science Board Study on "Dismounted Operations in Complex Terrain"
- 1700 Program Chair/Organizational Committee "Hot Wash Up"

DAY 3: Working Group/Plenary Sessions

- 0700 Registration
- 0800 Morning Working Group Sessions
- 1200 Luncheon Speaker: **LTC(P) Joseph Anderson**, USA, Instructor, US Naval War College
- 1300 Plenary Session: Individual Working Group Reports
- 1600 Program Chair/Organizational Committee "Hot Wash Up"