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## Potential combat operations with Iraq

In support of the Navy and the Marine Corps in the war with Iraq, CNA has deployed analysts to key commands in the region. They are collecting data and insights for our post-conflict reconstruction and analysis—what happened, why, and what it may mean for the Navy and Marine Corps in the future.

For COMUSNAVCENT, we will examine intelligence, surveillance, and reconnaissance; strike execution and effectiveness; multi-CV and cross-theater operations; surface operations; and logistics. To collect the necessary data, CNA analysts are on-scene in Qatar with CENTCOM's Forward Headquarters; in Bahrain with NAVCENT, CTF-53, and CTF-57; at the Combined Air Operations Center at Prince Sultan Air Base, KSA; at Sixth Fleet and CTF-63; and aboard all the aircraft carriers in the area.

For COMUSMARCENT, we will examine force deployment/redeployment operations, I MEF combat operations, operational logistics, and componentry. CNA analysts are on-scene with MARCENT, I MEF, and the Marine Logistics Command in Kuwait. (Contact: Ms. Maureen Wigge, (703) 824-2490, or Mr. Mark Geis, (703) 824-2745))

## Information technology in the Navy

As a follow-on to an earlier CNA examination of the performance of IT systems and their use within the fleet, we are collecting data from five battle groups during their composite unit training exercises. Our analysis has provided useful information on web use, JSIPS performance, Internet Relay Chat (IRC) use, and the bandwidth required by each. We are using insights from our IT work to examine the C4ISR requirements of the littoral combat ship (LCS). This study, using our knowledge of IT systems and our recent UAV work, derives detailed bandwidth requirements for the LCS. These requirements assume that

none of the raw data collected by off-board systems deployed from the LCS will be sent off the ship. We also examined different communications systems that could be used to fulfill these requirements and the types of technology investments that could improve their performance.

CNA has been helping to articulate the fleet operational requirements for collaborative tools. In a previous study, we outlined best practices for IRC, which is being used for tactical C2 and situational awareness. More recently, our work on USS *Nimitz* and USS *Theodore Roosevelt* exposed limits on the number of IRC users in theater, which could adversely affect operations. These data led the Navy to upgrade its chat servers to handle the increased number of users that various theaters are experiencing. We are continuing to monitor the use of chat in the fleet and advocate improvements to the existing architecture. (Contact: Dr. Sunoy Banerjee, (703) 824-2064)

## Communications options for naval UAVs

Future warfighting concepts assume a much larger role for unmanned aerial vehicles (UAVs), performing a wide variety of tasks, both lethal and nonlethal. Yet, if concepts involving large numbers of naval UAVs are to be realized, an adequate communications infrastructure must exist. We examined both the UAV data rate requirements and the various options for how a future naval UAV might communicate with its controllers and disseminate its sensor data.

Despite great strides in data-compression technologies over the past decade, particularly in imagery compression, numerous communication challenges threaten to prevent the wider use of naval UAVs. The major challenges are different for line-of-sight (LOS) and beyond line-of-sight (BLOS) operations. Within LOS, the most significant challenges surround the need to operate multiple UAVs simultaneously. Beyond line-of-sight, the communications options include the

use of airborne relays, military satellites, and commercial satellites. Each option has its advantages; the best choice may depend on the scenario and class of UAV being considered. In addition, the constraints imposed by operating naval UAVs from ships further complicate the communications problem and limit a ship's ability to communicate reliably with multiple UAVs.

Another significant challenge relates to jamming—a possible cost-effective way for an unsophisticated adversary to achieve a mission kill against a UAV. We suggested several ways to mitigate the threat; however, a long-term solution requires that any future communications relay system, whether it's a satellite or an airborne relay, explicitly consider UAV communication requirements.

Finally, DoD should emphasize technologies—such as image recognition and other artificial intelligence techniques—that may reduce the data-rate requirements. In addition to easing the burden on wireless communications systems, further reduction in data rates will permit easier use of spread-spectrum techniques for protection of data links. The cost, weight, and power requirements for information processing continue to decline, and advances are more likely to occur—or at least be more cost-effective—in further reducing data rates than in developing new methods to protect data links with high information bandwidths. (Contact: Dr. Kevin Kirk, (703) 824-2845)

## **Southwest border enforcement**

Countering illegal immigration into the United States along the southwest border presents a difficult enforcement challenge. Pursuant to that challenge, using historical data, we developed an analytical framework to help the INS, now part of the Department of Homeland Security, to evaluate the effectiveness of its enforcement activity and its effects on the “flow” of would-be illegal border-crossers.

In earlier work for the INS, we constructed an operational model for the U.S. Border Patrol (BP) and applied that model to develop a picture of the trends in enforcement effectiveness. That work suggested that deflection of would-be illegal entrants from one sector to a neighboring one might be important in explaining

some trends in reported apprehensions. In our current work, we built on that earlier model by including enforcement activities at established ports of entry (POEs), focusing on the deflection process, in which individuals switch from harder-to-cross locations to easier ones, and allowing for the possibility of deterrence resulting from the enforcement activity.

Using UN census data for the Mexican population, we estimated the trends in the number of individuals attempting illegal entry and combined this with a “local incentive” factor based on U.S. unemployment rates near the BP sectors to model changes in the flow of would-be illegal crossers. We matched the historical data for apprehensions and found that increased border enforcement was indeed a deterrent. Further, deflection plays a critical role in explaining the trends in the western-most sectors. We found little or no evidence for net shifts in flow from attempting to cross in the BP areas to attempting to cross illegally at ports.

The framework we developed in this analysis can play a key roll in future border enforcement evaluations, an area of high current interest. By applying the framework, CNAC was able to evaluate major trends in border enforcement activities and assess their effects on the flow of would-be illegal entrants in the past 11 years. (Contact: Dr. Stuart Dunn, (703) 824-2444)

## **Mainstreaming MIW within the IDTC**

Mine warfare (MIW) is one of the many areas in which carrier battle groups (CVBGs) and amphibious ready groups (ARGs) are required to demonstrate and be certified during their interdeployment training cycle (IDTC). Familiar with CNA analysis of MIW during Joint Task Force Exercises (JTFEXs) and thinking ahead to the organic mine countermeasures systems planned for CVBGs and ARGs, Commander, Second Fleet (C2F) asked CNA to help incorporate MIW training throughout the IDTC. Working with Commander, Cruiser Destroyer Group Eight, we followed the progress of three CVBGs through their workups providing analytical assistance where needed, and focused on MIW in the JTFEX assessments.

The phased introduction of MIW in the IDTC took the form of a “crawl-walk-run” approach in which

successive CVBGs could build on previous results. We worked with each CVBG staff and with C2F exercise planners to improve the MIW portion of each JTFEX. During the first two JTFEXes, we observed their MIW performance and assessed the command-and-control structure in place in the CVBG. A comparison between these two exercises and the previous JTFEXs shows the significant positive impact training had on MIW performance. We plan to observe one more JTFEX (as real-world events allow) and look at MIW training trends over the observed JTFEXs. This work has been followed by the Third Fleet staff, who asked us to observe MIW in their most recent JTFEX. (Contact: Dr. David G. Taylor, (703) 824-2821)

### **Chinese warfighting: The PLA experience since 1949**

Despite growing research interest in the modernization of the Chinese People's Liberation Army (PLA) and an expanding body of literature on Chinese military modernization and defense policy, there is still a dearth of solid historical narratives or analyses in English of the operational experiences of the PLA since 1949. In view of the new possibilities for research, the new talent in the field of Chinese history and military and diplomatic affairs, and the niche that needed to be filled, CNA's Asian security studies center, Project Asia, held an academic conference to explore the operational history of the Chinese People's Liberation Army (PLA) since 1949. Our conference report focuses on major combat episodes of the PLA, covering the Korean War, the Taiwan Strait crises of the 1950s, the 1962 Sino-Indian War, the 1969 Sino-Soviet border clashes, and the 1979 border war with Vietnam. It also includes an overview of the 50-year evolution of PLA military doctrine and overviews of the PLA Navy and PLA Air Force "at war."

Although this report cannot provide a comprehensive history of PLA warfighting over the past half century, it does offer information and insights from a mix of scholars. Readers will properly draw their own conclusions from this collection. In some cases, more questions will be raised than answered, but we hope this report will at least serve as a vehicle for continued dia-

logue and debate and inspire future scholarship. (Contact: Dr. David Finkelstein, (703) 824-2952)

### **Savings from reverse auctions less than expected, but still sizeable**

An open auction is a competition in which the suppliers know all the bids and compete for DoD business by lowering their individual bids. The Navy has reported 20- to 30-percent savings by using open auctions instead of the traditional purchases. However, these savings estimates are based on expected prices that might be unrealistic, rather than actual purchases, and thus might be unreliable. We found a large number of DLA purchases that provide a basis for comparing purchases using different procedures. In August of 2000, the Defense Supply Center in Columbus switched from sealed-bid to open-bid procurement auctions. We found that the costs on contracts declined about 4 percent, and the more bidders, the greater the decline. Although the percentage savings are well below those previously estimated, they could still be significant. Such auctions could be used for billions of dollars of purchases, with potential savings of hundreds of millions. (Contact: Dr. Brent Boning, (703) 824-2240)

### **Navy could cut current accessions with little risk**

In response to concerns that the Navy will exceed its FY03 military personnel budget, we looked at the appropriate level of accessions for the year—specifically non-prior-service accessions, which are the vast majority of the recruits. We examined two key factors: the appropriate continuation behavior to assume for the current force, and the risks associated with coming in under the steady-state accession level for a year or two. Continuation rates, which have varied widely over the past six years, were extraordinarily high in FY02. If the Navy uses FY01 rates as its benchmark, the steady-state accession rate would be about 46,000. But, the Navy is better managing its losses today, and the economy in FY03 is likely to remain weak. After making these adjustments to the FY01 continuation rates, we found the current number of accessions could be closer to 42,000. We also found that FY00 and

FY01 accessions were oversized; so the Navy could make further cuts in FY03 or FY04 with modest risk.

Our analysis showed that:

- Each 1-percentage point change in the civilian unemployment rate changes the accession requirement by 600. For the range of unemployment witnessed over the draw-down, the requirement could vary between 41,000 and 46,800.
- Each 1-percentage point change in the reenlistment rate changes the accession requirement by between 400 and 500. With a 65-percent first-term reenlistment rate (vs. the current 57-percent goal), the requirement would be 39,200.
- Each 1-percent change in basic pay changes the required accessions by 450 to 550. For a one-level increase (decrease) in the selective reenlistment bonus, accession requirements decrease (increase) by between 1,100 and 1,400 recruits.

(Contact: Dr. Michael Hansen, (703) 824-2252)

### **Best way to access physicians hinges on required seniority mix**

To examine the optimal mix of accession sources for military physicians, we developed an optimization model to look at the effect of various policy changes on the cost and mix of the military's physician force. We found that, under the current seniority structure, the military medical school physicians trained in military residency programs are the most cost-effective accessions, because physicians from these programs have high retention rates and are cost-effective at filling senior, experienced positions. OSD is interested in exploring graduate medical education (that is, making greater use of the deferred accession program). Our results suggest that this step can be cost-effective only if DoD lowers the seniority requirements or increases the retention rates of these accessions through higher

pay and bonuses. DoD may want to make the force more junior, but it should understand that the military medical system already has a more junior staff than typically found in civilian hospitals. (Contact: Ms. Shayne Brannman, (703) 824-2932)