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Reply to  
Attention of:

March 19, 2014

MEMORANDUM FOR RECORD

SUBJECT: M&S Wargaming Results Executive Summary

1. PURPOSE. The purpose of this memorandum is to summarize the analytical findings and key takeaways from the Gold Team's record wargame play analysis.

2. Analysis background. This statement may come from the analysis plan. Taiwan is a country constantly living under the threat of a Chinese invasion. Rapid growth of the Chinese People's Liberation Army (PLA), regional sovereignty disputes, and regional rogue state actors reinforce this threat to Taiwan. Concurrently, Taiwan struggles with domestic security concerns which include diminishing defense budgets and force strengths, a public perception that the threat to Taiwan is diminishing, and the possibility of environmental disasters.

a. Given this environment, the Taiwanese Ministry of National Defense desires to develop a Live Virtual Constructive Capability to support Training as well as testing & operations. They wish to develop an investment strategy for developing this capability and gain a clear understanding of the trade space associated with LVC. This wargame will address the following issues:

- 1) Developing a service and joint investment strategy across the modeling and simulation domain
- 2) Identifying the trade space encompassing live, virtual, and constructive training environments
- 3) Developing a baseline process that enables policy makers to investigate varying courses of action

b. Problem Statement. Gold Team develops a tool that compares the trade space within the Live, Virtual, Constructive training environment to enable the Taiwanese MND in developing a M&S strategy to enhance Joint Warfighting Capabilities IAW the Republic of China (Taiwan) 2013 QDR.

3. Analysis purpose and objectives. Analysis of this wargame facilitates identification of

multiple factors in the M&S investment decision-making process. These factors include the degree to which service budget impacted M&S investment decisions (EEA1), the degree to which each individual M&S system's cost-to-proficiency ratio affected the services' M&S investment decisions (EEA2), and the degree to which inter-service cooperation affected service acquisition decisions (EEA3).

#### 4. Analysis methods.

a. Analysis of EEA1 included a quantitative identification of the EEA1 MOE, the ratio of cost-to-proficiency for each services' individual M&S investment decisions. Comparing the MOEs between the services allows for an identification of which service focused most heavily on the individual M&S systems' cost-to-proficiency ratio gains in their decision-making. Addressing these decisions relative to the timeline allows for an assessment of the prioritization of investment decisions by each service. Those services with higher MOEs for earlier turns focused on the system cost-to-proficiency benefits of their M&S system acquisitions.

b. Analysis of EEA2 included a quantitative identification of the MOP, total proficiency derived from each training area (ie. live, virtual, constructive) ,and the MOE, ratio of cost to proficiency for each training area, for each service. Looking at the total proficiency derived in virtual and live training, as well as the live benefits made from virtual training (ie. constructive training), allows for an identification of the overall proficiency gained from each training modality and can help with identifying the optimal mix of LVC systems at the various stages in the M&S infrastructure development.

c. Analysis of EEA3 included both a qualitative and quantitative analysis of the degree to which individual services benefited from joint cooperation in M&S acquisitions. The quantitative analysis included tallying the number of joint acquisitions executed per service and the comparing the benefits gained from those acquisitions, in terms of the proficiency-to-cost ratio, to the benefits gained from unilateral system acquisitions. The qualitative aspect of EEA3 assessment included a review of the comments made by the players at each turn, where they provided their reasoning for each decision and where the timing decision of each investment decision could be identified.

#### 5. Analysis findings/recommendations.

a. In this description of findings only the major lessons learned from analysis of each of the three EEAs will be identified. Analysis of the results of the wargame resulted first in the identification of an error in the book keeping. The Marine Corps is documented as having paid its second year acquisition fees for the Amphibious Support system twice. Luckily this error occurred on the last turn of the game, making correction simple and minimally affecting analysis. Analysis of the wargame is conducted with a corrected form, allocating the previously misallocated and unspent Marine Corps funds to live training in Amphibious Support and thereby bringing the total final training effectiveness levels of each service to the following percentages:

Army: 92.9%	Air Force: 93.75%
Navy: 92.1%	Marine Corps: 94.2%

b. Even more important than these final training effectiveness levels are each services' improvement from their starting service training effectiveness levels. For each service these percent improvements in service effectiveness over the course of the five turns of the wargame are:

Marine Corps:	+ 5.3%
Air Force:	+ 5%
Army:	+ 3.2%
Navy:	+ 0.7%

c. These values, as well as the component cost and training effectiveness levels established throughout the course of the entire wargame, provide the values supporting the quantitative analysis of EEAs 1, 2, and 3.

d. EEA1 Analysis:

1) None of the services began their acquisition process by acquiring the M&S system with the lowest cost-to-proficiency ratio. This suggests that the services were focusing on other factors more than they focused on the cost savings benefits of individual M&S systems. When relating the service areas of responsibility it is clear that these played a significant factor in the services' decision-making process. For every service one or both of the first and second acquisitions was a system that of either primary or secondary focus in their respective service responsibility rankings. Surprisingly the Marine Corps, which realized the greatest percent increase in service efficiency, placed the least emphasis on the service capability requirement weighting of the M&S investment options. This means that the LVC component weighting, which will be discussed in the analysis of EEA2, must have played a larger role in determining successful M&S investment planning.

2) A related area of interest is each service's pursuit of the live training benefits to be gained from constructive training. Although each service maintained a combination of virtual and live training for all M&S systems acquired, the balance varied significantly between services. The Navy exploited the benefits of constructive training the least of all of the services. While all other services achieved at least 50% M&S training, the threshold required to achieve a 20% increase to the benefits of live training, for all M&S systems purchased, the Navy achieved only 25% M&S training for all four of the M&S systems it purchased. This demonstrates that the Navy not only limited the amount of constructive training it conducted, but also limited the amount to which it benefited from its investments in M&S training systems by only minimally employing the systems. This combination of minimal M&S training use and minimal pursuit of constructive training benefits may explain why the Navy had the least amount of service effectiveness improvement over the course of the wargame.

e. EEA2 Analysis:

1) To conduct an assessment of the how each service employed live, virtual, and constructive training it is helpful first to identify the amount of training effectiveness was derived from each type of training for each service. The below values identify those percentages of training independent of the effects of service responsibilities on training weighting:

Training Type\Service	Army	Navy	Air Force	Marine Corps
Live	44.1%	66.2%	45.7%	50.3%
Virtual	50.1%	28.6%	48.6%	41.9%
Constructive	5.8%	5.2%	5.7%	7.8%

2) It is notable that if one ranks the services in order of Constructive Training training efficiencies, the result is the same as the order of percent service training efficiency increase that was discussed earlier. This suggests that the service which succeeds in conducting the greatest amount of constructive training succeeds in creating the most efficient and effective M&S investment and training plan. As the degree of constructive training is a result of the amounts of live and virtual training conducted, it should also be considered that the reason for success may also be due more to the optimized combination of stand-alone virtual and live training than constructive training. Regardless, a relationship is undeniably seen between the allocation of training across live, virtual, and constructive mediums and the benefits seen in overall service efficiency improvements.

f. EEA3 Analysis:

1) Analysis of inter-service cooperation in the acquisition of M&S systems also proved of secondary importance to service division of training between LVC capabilities. The Marine Corps, which realized the greatest improvement in service efficiency did not execute a joint acquisition until the last turn, when a joint acquisition was executed with the Army. The Navy and the Army were tied for executing the greatest number of joint acquisitions, with both services executing two joint acquisitions and one acquisition of a system previously acquired by another service. It would be beneficial to execute additional wargames to identify whether the Marine Corps approach to the division of training across the LVC spectrum would be further improved or impeded, specifically in terms of timeline, by increasing the amount of inter-service coordination in acquiring M&S systems.

2) These findings, organized across the three EEAs, demonstrate just a few ways in which this wargame can provide insight to players and other stakeholders when assessing how best to build a national military M&S infrastructure for training. Although the training efficiency and cost values utilized for this wargame were synthetically generated, this analysis demonstrates how the wargame provides a framework for assisting decision-makers in M&S investment planning once more

accurate M&S and live training efficiency and cost data can be acquired to replace the current synthetic values.

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