

Counting the Costs of Simulation

Measuring What You Are Not Spending

Simulation is playing an ever increasing role within Defense and is now woven through all elements of training, experimentation, analysis and operations. To date this adoption has been, in part, generated by the view that simulation saves money and increases capability.

While the technology argument seems to have been made, and is supported by clear observational and anecdotal data from the field, the collection of actual costs and cost benefit data remains more elusive. This paper details the use of Calytrix's LVC Cost Counter to capture, analyse, and report on the cost savings achieved through the application of simulation.



SIMULATION SAVINGS: LVC COST COUNTER

Measuring What You Are Not Spending

Overview:

Simulation is playing an ever increasing role within Defense related organizations and industry. From the traditional basis of supporting individual training the scope of simulation has expanded to include collective training, experimentation, capability development and operational support. With the establishment of key simulation capabilities, there can be little doubt that the application of simulation in analysis, training and operations is coming of age. To date, this adoption has been, in part, generated by the view that simulation saves money and increases capability.

While the technology argument seems to have been made, and is supported by clear observational and anecdotal data from the field, the collection of actual costs and cost benefit data remains more elusive. This is especially so in an increasingly complex Live, Virtual and Constructive (LVC) arena where simulated effects are blended in real time with live training. It has often been stated that accurate “Costings and the Cost Benefit Analysis for Simulation” is the missing link in the argument for simulation. Without clear empirical data on the value of simulation, it is difficult to articulate a solid business case for deeper integration of simulation into the underlying capability development and training life-cycles.

The outcome of a Cost Benefit analysis will imply different things to different people depending on their focus, and indeed much of the analysis will remain subjective. Questions such as, “How can I measure training benefit?”, “Did this simulation save money?”, “Would I have used a real platform if a simulation system was not available, and what does that decision mean?” etc., will remain. Before we can even start

End State:

Utilizing Calytrix LVC Cost Counter, Commanders and staff can accurately articulate the savings being made by their simulation systems. Imagine the impact of seeing a large screen above a simulation center or in the Headquarters of a training establishment showing a running/live total of the savings being made by the Unit’s simulation systems. The capture and visualization of that cost data is a powerful message.

to answer these types of questions, we must first be able to collect the underpinning data that would be required to support a proper analysis. However, an inexpensive utility program to calculate costs, with calculations based on user-defined cost models (cost information accepted and validated by the user), has not been available as a commercial off-the-shelf (COTS) product until the release of Calytrix's LVC Cost Counter in 2011.

Calytrix's "**LVC Cost Counter**" is a software program, initially developed for the Australian Defence Force, which monitors a computer network (using DIS/HLA standards) and accumulates and displays the individual, category and total costs associated with simulation events. Able to work on all of Defense's 'standards-compliant' simulation systems, LVC Cost Counter enables users to accurately measure and conduct deeper analysis into the application and cost savings being achieved through the use of simulation.

Defense organizations have a myriad of simulation systems in use across a variety of domains equally supporting individual and collective training, experimentation, analysis, and operational preparation. Broad functional areas that now utilize simulation include:

- Training,
- Force Assessment,
- Experimentation,
- Research and Development,
- Capability-Life-Cycle Management,
- Crisis Management and Planning,
- Mission Rehearsal, and
- Conduct of Operations.

In order to support future simulation capability requirements, a definitive understanding of cost savings is required. It is clearly understood that 'cost' is only one element in determining the utility or benefit of simulation but it is the area to which a lot of discussion is focused.

Calytrix's LVC Cost Counter provides Defense with definitive data on the cost savings of its simulation systems. As an example, the system is able to definitively state the actual cost savings of conducting individual training such as a tank gunner's course or JTAC course, the savings for ongoing pilot training using simulation, or the collective savings of using a constructive Combat Team or F-16 squadron and UAVs in support of a Mission Rehearsal Exercise.

LVC Cost Counter logs all of the various events that occur during an exercise that would incur cost in the real world and automatically calculates an approximate cost based on the resources consumed. LVC Cost Counter can be used on all standards-compliant simulations and allows costing data to be collected and analyzed. The system enables users to create a number of different costing tables, each containing data such as, but not limited to:

- the cost of munitions,
- operational cost per hour,
- operational cost per km travelled,
- daily maintenance rates,

- average salary costs, and
- platform damage costs.

Once a costing model is applied to each entity type, the system calculates the cost of the entire simulated exercise. For example, the system will know how many 30mm rounds were fired in the simulation and multiply that by the cost of a round. In addition, maintenance and/or operating costs are applied on a time or distance basis. LVC Cost Counter could potentially be used to collect base data for every single simulation across Defense, and automatically send the data to a central repository for collection and further analysis.

Accurate Costs:

Cost Counter calculates using user-defined data stored in an underlying relational database. The key point is that the user of Cost Counter defines the content (and thus the quality) of the data in that database, which of course includes the individual costs of many dozens, hundreds, or thousands of items. Defense has accurate costs associated with the acquisition of platforms and munitions and has developed accurate costs for their ongoing sustainment. This is normally reflected in the cost per hour of an aircraft, the cost per mile for a tank or the cost per steaming hour of a ship. These costs are simply transferred into Cost Counter.

The screenshot shows the Calytrix LVC Cost Counter interface. The main window displays a table of entity types and their costs. The table is titled 'Costings' and is for 'Cost Model Default'. It shows 29 types, with the first 20 displayed. The table has columns for Entity Type, Cost, and a search box. The data is as follows:

Entity Type	Cost	Cost	Cost
120mm apds	\$ 950.00 /round		
30mm he	\$ 65.00 /round		
46mm	\$ 65.00 /round		
5.56	\$ 0.65 /round		
5.56 2	\$ 0.65 /round		
7.62mm	\$ 0.75 /round		
apache	\$ 11000.00 /hr	\$ 0.00 /km	\$ 16000000.00 /repair
arh	\$ 11000.00 /hr	\$ 0.00 /km	\$ 16000000.00 /repair
blue soldier 1	\$ 90.00 /hr	\$ 0.00 /km	\$ 0.00 /repair
blue soldier 2	\$ 90.00 /hr	\$ 0.00 /km	\$ 0.00 /repair
blue soldier 3	\$ 90.00 /hr	\$ 0.00 /km	\$ 0.00 /repair
blue soldier 4	\$ 90.00 /hr	\$ 0.00 /km	\$ 0.00 /repair
chinook	\$ 2000.00 /hr	\$ 0.00 /km	\$ 15000000.00 /repair

Screenshot of an example Costing Model

Methodology:

LVC Cost Counter’s methods are straightforward. Cost Counter monitors (‘listens to’) the computer network. Whenever an activity occurs, Cost Counter retrieves the cost of that activity from its underlying (user-defined) database and adds that cost to the accumulating totals for that individual item, that item’s category, and the overall total cost for the activity. In real-time, as LVC Cost Counter detects network activity, updated figures are available for onscreen display or generation of reports. LVC Cost Counter’s GUI and output reports are presented via HTML feed to any modern web browser (e.g. Internet Explorer or Firefox), enabling access by both local and remote users (with access permissions, of course).

The screenshot displays the 'Entity Cost Report: apache [ah64_1]' interface. The top navigation bar includes the 'cost counter' logo, the application name 'Calytrix LVC Cost Counter' (Build: 2.0), and a 'Support' link. The main content area shows the report title and key cost figures: 'Total cost for the entity "apache" with the marking "ah64_1" is \$822,169.17' and 'Cost excluding munitions fired is \$6,169.17'. The report is divided into several sections:

- Summary Costings:**

Time Cost	based on total time at \$11,000.00 per hour	0.56 hours	\$ 6,169.17
Movement Cost	\$0.00 per kilometer	69.818 kilometers	\$ 0.00
Damage Cost	\$16,000,000.00 per repair	0.00 repairs	\$ 0.00
Sub Total			\$ 6,169.17
Munition Cost			\$ 816,000.00
Grand Total			\$ 822,169.17
- Munition Costings:**

12 x hellfires	\$68,000.00 each	\$ 816,000.00
Grand Total		\$ 816,000.00
- Other Statistics:**

Total Elapsed Time	33 minutes, 39 seconds
Distance Travelled	69.818 kilometers

The left sidebar contains navigation options: LVC Cost Counter, Summary Reports (Total Entity Cost, Total Munition Cost, Total Cost, Live Counter), Entity Reports (by Entity, by Entity Type), Munition Reports (by Munition Type), Cost Models (Models, Costings), Settings (Entity Types, Session Editor, Report Settings, Data Import/Export), and External Links (LVC Game Product Page).

An example individual Entity Report

Training Example:

LVC Cost Counter was initially used on Exercise Talisman Saber 2011 (the major bi-annual exercise between the United States and Australia). During this exercise, Cost Counter determined the cost savings of using constructive UAVs (Predator and Reaper) and constructive

maritime assets as part of an Australian Maritime Task Group. Throughout the exercise, LVC Cost Counter provided a running total of costs savings and within minutes of the conclusion of the exercise provided a consolidated report. The data is now being used by Director Joint Combined Training Capability (DJCTC) to articulate the case for additional simulation support for Mission Rehearsal Exercises.

Potential User Cases:

Most Commanders and staff will rapidly identify where and how LVC Cost Counter could be used within their organizations but some simple examples include:

Individual training environments: Many individual training establishments utilize simulation as part of their training continuum. Linking Cost Counter to simulation systems such as all the AFV simulators, artillery simulators, flight simulators, etc., provides empirical data to justify the system. Commanders at all levels can truly articulate the case for simulation saving.

Low level team to sub unit training: Often a number of simulators are linked to provide reasonably low level collective training. This can be as low as linking a couple of HMMVs to conduct patrol rehearsal through to sub unit training involving a range of AFVs and support assets. The same is true for linking a couple of aircraft or maritime simulators to conduct relatively low level collective training. LVC Cost Counter monitors all of the activity and provides a range of reports detailing total costs, aggregated costs for each equipment type (e.g., all the M1A1 tanks) down to the costs associated with each piece of individual equipment (e.g., an individual vehicle).

Live, Virtual and Constructive exercises at all levels (Single Service, Joint and Combined): LVC Cost Counter simply sits on the network, monitoring and logging all of the DIS/HLA information. In essence, this means that all network traffic is being analyzed. It doesn't matter whether that traffic is related to Live, Virtual or Constructive assets: all related costs are recorded.

The following example from Talisman Sabre 2011, a joint US and Australia training exercise, highlights the capability of LVC Cost Counter:

*An Australian infantry company, on an instrumented range in Northern Australia, is approaching an area to secure a High Value Target. Air support is provided by **live** FA18 aircraft flying over the range and equipped with instrumentation pods, plus **constructive** (simulated) FA18s, and a **virtual** AC130 aircraft provided from a US Air Force flight simulator at Hurlburt Field, Florida. The military operation is viewed in the headquarters (HQ) using a **constructive** unmanned aerial vehicle (UAV). The entire operation takes an hour or so, during which time LVC Cost Counter records all of the M16 rounds fired by the soldiers, the number and type of all the constructive artillery rounds fired, the time of aircraft support and the number and type of weapons they fired, the amount of UAV support, and any damage sustained. Within a few minutes of the end the operation, LVC Cost Counter provides a detailed report detailing all costs associated with the training event. The report accurately shows the total cost of the activity, if it had been done*

utilizing real assets, and once again supports Commanders articulating the case for simulation or the increased use of simulation.

Experimentation. LVC Cost Counter can be used to analyze costs associated with a wide range of experimentation. In support of Force Structure analysis, LVC Cost Counter can be used to project future equipment costs and its impact on other systems. For example, the user might prepare the estimated cost of firing a new, yet-to-be-produced, missile based on cost projections for 5 years in the future. In that case, LVC Cost Counter’s calculated results associated with that missile would be useful in the context of ‘five year estimates’.

Course of Action (COA) Analysis. LVC Cost Counter could be used to analyze the costs, and limited logistic data, associated with both training and operational COA analysis. While not endeavoring to replicate logistic data, LVC Cost Counter will provide accurate reports on distances travelled and hours of operation.

The screenshot displays the Calytrix LVC Cost Counter interface. At the top, it shows the title 'Calytrix LVC Cost Counter' with 'Build: 2.0' and 'Licensed until: 2012-08-30'. The main content area features a 'Total Cost \$1,136,226.19' summary. Below this, a table breaks down the costs into three categories: Entities (\$106,895.19), Munitions (\$1,029,331.00), and Combined (\$1,136,226.19). A secondary table lists 59 individual entity costings, including items like 'apache', 'blue soldier 2', 'blue soldier 3', 'chnook', and 'civilian 1', with columns for Type, Marking, Entity Cost, Munitions Cost, and Total Cost.

Entities	Munitions	Combined
\$106,895.19	\$1,029,331.00	\$1,136,226.19

Type	Marking	Entity Cost	Munitions Cost	Total Cost
apache	ah64_2	\$6,169.17	\$78,000.00	\$84,169.17
apache	ah64_1	\$6,169.17	\$816,000.00	\$822,169.17
arh	arh_1	\$6,169.17	\$32,500.00	\$38,669.17
arh	arh_2	\$6,169.17	\$32,500.00	\$38,669.17
blue soldier 2	sold_8	\$2.20	\$0.00	\$2.20
blue soldier 3	sold_1	\$50.33	\$0.00	\$50.33
blue soldier 3	sold_5	\$50.23	\$0.00	\$50.23
blue soldier 3	sold_4	\$50.43	\$0.00	\$50.43
blue soldier 3	sold_2	\$50.23	\$0.00	\$50.23
blue soldier 3	sold_3	\$50.43	\$0.00	\$50.43
blue soldier 3	sold_6	\$50.13	\$0.00	\$50.13
chnook	ch47_2	\$1,121.67	\$3,822.00	\$4,943.67
chnook	ch47_1	\$1,080.56	\$9.00	\$1,089.56
civilian 1	civ_8	\$25.11	\$0.00	\$25.11
civilian 1	civ_7	\$25.11	\$0.00	\$25.11
civilian 1	civ_1	\$24.44	\$0.00	\$24.44
civilian 1	civ_10	\$25.05	\$0.00	\$25.05
civilian 1	civ_4	\$24.31	\$0.00	\$24.31
civilian 1	civ_2	\$25.23	\$0.00	\$25.23
civilian 1	civ_3	\$25.23	\$0.00	\$25.23

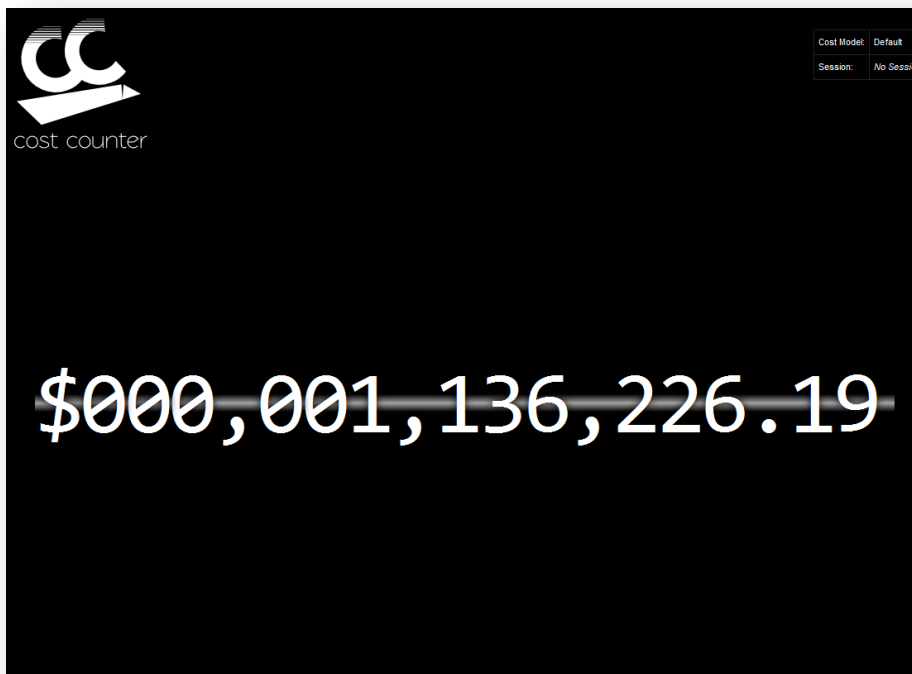
Screenshot from an example Total Cost Report

Support to Acquisition:

Anecdotal evidence supports the view of military and industry that simulation saves money. However, accurate, empirical data has been the missing element in the argument for acquisition of additional simulation systems to support the military's assertions. LVC Cost Counter now provides that data. By recording the savings made through the use of simulation, Commanders can clearly articulate the case for additional systems. This data is invaluable to acquisition (purchase) committees.

Conclusion:

The use of simulation is now pervasive in the military, woven through all elements of individual and collective training. However, defining the cost savings associated with simulation has, to date, been problematic. Utilizing LVC Cost Counter, Commanders and staff can accurately articulate the savings being made by their simulation systems. Imagine the impact of seeing a large screen above a simulation center or in the Headquarters of a training establishment showing a running/live total of the savings being made by the Unit's simulation systems. The capture and visualization of that data is a powerful message.



Screenshot of the 'live' counter

FOR MORE INFORMATION ABOUT LVC COST COUNTER:

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An online demonstration of LVC Cost Counter is available at:

<http://lvccostcounter.calytrix.com/frontpage>