Keynote Address by Future Systems Architect, BG Jimmy Khoo at C4I Asia Conference

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BG Jimmy Khoo giving his opening speech at the C4I Asia Conference.

Guest of Honour Prof Lui Pao Chuen, distinguished ladies and gentlemen,

The other day, as I was surfing the internet, I came across a poem. A poem about the fascinating and bewildering language called English.

Let's face it
English is a funny language.
There is no egg in the eggplant
No ham in the hamburger
And neither pine nor apple in the pineapple.
English muffins were not invented in England
French fries were not invented in France.

We sometimes take English for granted
But if we examine its paradoxes we find that
Quicksand takes you down slowly
Boxing rings are square
And a guinea pig is neither from Guinea nor is it a pig.

If writers write, how come fingers don't fing.
If the plural of tooth is teeth
Shouldn't the plural of phone booth be phone beeth
If the teacher taught, Why didn't the preacher praught.

If a vegetarian eats vegetables
What the heck does a humanitarian eat!?
Why do people recite at a play
Yet play at a recital?
Park on driveways and Drive on parkways

You have to marvel at the unique lunacy
Of a language where a house can burn up as
It burns down
And in which you fill in a form
By filling it out
And a bell is only heard once it goes!

English was invented by people, not computers
And it reflects the creativity of the human race
(Which of course isn't a race at all)

That is why When the stars are out they are visible
But when the lights are out they are invisible
And why it is that when I wind up my watch
It starts
But when I wind up this observation,
It ends.
Bewildering indeed.

As I was preparing this address, the ditty reminded me that an entire new language is emerging. And this embryonic language is centred around the brave new world of network centric warfare. This language complicated as the English language, has strange combinations of letters and numbers and nouns and verbs such as RMA, XML, EBO, J2EE, 802.11, SMS, and it takes existing words and give them whole new meanings.

For example,

Peer-to-peer is not about sharing amongst friends,
Chat does not involve speaking nor meeting anybody
A server involves neither tennis nor a restaurant
A cache definitely does not store weapons.
And storage is not about places where you keep your unwanted clothes.

The complexities of languages are made much worse by the slight variations when used slightly differently throughout the world. NCW for example means one thing to Singapore and ac completely different thing to others and even our close friends from other countries. The only way to understand each other is to get together to clarify and share our views. And it is in this context that the C4I Asia conference was conceived. It would be platform to understand what many are thinking and doing around the world in NCW. It would be a platform to create shared situation awareness and perhaps a common operating picture.

So let me welcome all of you to C4I Asia 2004.

C4I Asia 2002 had overwhelming positive feedback and the Asian Aerospace organisers had decided that this would be a regular feature of the airshow. It is indeed appropriate as those who are in the business of defence would know the new critical importance of C4I in the new battlefield. You have seen some possibilities in the video. Victory would go the side that best exploits all the exciting technologies to gain the information advantage. Therefore, an airshow that only displays aircraft and aircraft technology is incomplete.

This year, we are indeed honoured to have with us, a very distinguished panel of NCW experts from around the world. All the speakers are not only practitioners, but are, or have been until recently, the key personalities behind the NCW movement in their respective countries. And I daresay that the speakers come from the countries that are at the leading edge of exploring and implementing the ideas behind network centric warfare.

In the last show, we had a tour of some of our C4I facilities. This year, to provide a change, which also saves you some time and travelling, we have spent time to assemble some of the experiments and capabilities we have been pursuing here so that you can browse through them at your own time. We have moved the mountain to you so that you need not make the long climb.

Now, as I was pondering about what to say this morning and as there is so much to talk about, I thought about the poem and the differences in understanding what networkcentric warfare means to different countries and even different people.

I thought I badly needed to do this as the other day, somebody thought that networkcentric warfare was about building an army of spidermen exploiting web technologies to net the enemy.

Yet another thought the networkcentric warfare was about shooting computers at your enemies.

Or that is about UFC – unmanned flying computers…

Or this.

Or this.

The problem of different understanding is so severe that I thought perhaps I would go down to real fundamentals.

Therefore, I am going to give you the Jimmy Khoo's "Dummies Guide to Networkcentric Warfare" and how we are applying this guide in Singapore. But since we do not have all day, I will tell you only about the first five chapters. I'll leave the experts after me to go into the more difficult fields.

Chapter One – "What Fog?".

The battlefield is a place of confusion, where there is abundance of information and yet paradoxically, no information - or more accurately no knowledge. Clausewitz has called this the Fog of War.

But yet the power of networks and sensors can lift this Fog, as Bill Owens, a former Vice Chairman of the US Joint Chiefs of Staff had said. I emphasise 'lift' and not 'eliminate' as we think it is neither practical nor necessary to remove the fog of war for 'Information Superiority'.

Let me illustrate the power of knowledge as a combat edge. I will borrow some of points from a group we are working with to exploit knowledge tools.

Today, I am sure many of the military officers and even the civilians have grappled with the issue of how to deal with homeland security and the clear and present danger of the terrorist threat. You would know that there are many challenges and one of them is about how to spot

the anomalies from the mountains and mountains of other information available. Therefore, based on your personal experience, you might have thought that it would have been impossible to identify the Sep 11 terrorists before Sep 11 2002.

Let me surprise you. This story was put together from open source data so that the points can be made.

It is quite amazing. The moral of the story here is that every piece of data can be knowledge and some will be critical knowledge – if you know how to exploit technology to piece together the millions of data, some less important than others, to form the relevant patterns and connections. Do not throw away data as they can be precious resources, especially since technology today can unlock their potential value.

Now, don't you think that the very same concept is also applicable in the battlefield? The characterisations are the same – millions and billions of data points to filter through but all can contribute significantly to enhanced knowledge and understanding. Every person, every piece of equipment on the battlefield with some sensing means, like a pair of eyes, is collecting information continuously. Unfortunately, most armed forces today would throw away the many minor intelligence reports, forward position sightings or even encounters with the enemy from fighting forces, as they do not know how to handle massive amounts of data, let alone collate them into a coherent picture. Therefore, valuable knowledge is being discarded all the time.

We in Singapore believe that the side that can exploit all the rich and abundant data would have a significant edge. We have conceptualised our thinking about how to realise the potential advantage of the network and sensor technologies in a framework called Integrated Knowledge Based Command and Control or IKC2 for short. You have seen some of this in the video. We have given you a copy of a monograph of the ideas, written early last year. I will therefore not elaborate but suffice to say that in this conceptualisation, we think that by lifting the Fog of War, we will be able to see more and see first, understand faster and better - ultimately allowing us to make superior decisions to direct the outcomes of battles.

We are experimenting and building capabilities. Most of these are classified but you can catch some glimpses of these in the exhibition outside.

Chapter Two. "It's Not the Technology, Stupid!'

Some fail to realise that NCW is less about the network technologies but more about the warfare concepts.

Indeed, we can be overwhelmed by the pace of the technology. In the mid-90s, few had personal experience with the internet. By the late 1990s, 200 million were already on the internet, but most were quite happily surfing at 14.4 or 28.8 kbps and if you are a little more lucky, 56 kbps. All thought that it was wonderful. Today, it is possible to go online even wirelessly at 11 Mbps - 200 times faster - and very soon with 802.11g at 54 Mbps, 1000 times faster. I now cannot remember how I could have survived with only 14.4 kpbs.

But in RMA, the real revolution catalyst is not so much the technology but the concepts and the ideas.

I told a story in a previous presentation recently. But it is a very funny story so I am going to share it here too as it has such important morals.

The US railroad gauge is 4 feet, 8.5 inches. Why such an odd number? …because the railroads were built by English expatriates…. …who used the same tools that they used for building wagons… …and this unique wheel spacing for the wagons was needed because of the ruts in the older roads….. …and the ruts were built by the Romans … …for their chariots

made just wide enough for the back ends of two horses.. But this is not all... The rockets of the Space Shuttle are made in Utah and cannot be any larger … …because they must be transported by rail through the mountains… …and the tunnels are made just slightly larger than the railroad track… Therefore, a major design specification of the world's most advanced transportation system was decided over two thousand years ago by the width of a horse's behind.

I am not sure about the truth of this story – you cannot believe everything you read on the internet. But the point is nevertheless accurate. We cannot just continue with existing practices although new technology makes new things possible. Innovation is critical.

We see how technology might be used in combination with concepts in this 4 by 4 matrix, which is a framework we discussed with John Kao of Kao and Company.

On the left-hand side, one would only either be realising incremental improvements in the case of using existing technologies or just satisficing by using new technologies with existing concepts.

The innovator's dream is to live in the right column, where new disruptive concepts are generated either with existing or new technologies.

In history, there are many examples of military innovation. One favourite is German innovation in World War II. Let's look at some of the numbers again. In May 1940, the Allies actually had a numerical edge of 1.3 to 1 in tanks, and many had superior protection and armament technologies, an edge of 1.2 to 1 in manpower and the French had built what was thought to be the formidable Maginot Line. Superior concepts and exploitation of technology created a stunning victory for the Germans.

In Singapore, we think that Innovation is an important element of IKC2. We want to nurture an environment and culture that constantly innovates. We want to nurture an environment and culture that does not insists on formulating plans to fight tomorrow's wars with yesterday's concepts.

Various major initiatives have been launched.

For example, a Future Systems Directorate with a group of very young people without any understanding of what is not possible has been formed to generate more ideas outside the mainstream planning system and to challenge the system with different views. It has been given up to 1% of the Defence Budget to conduct experimentation and steer the transformation movement. The story of FSD is one whole story that perhaps I can tell another day.

To tap the complete network of people in the armed forces, we are re-orienting the productivity movement, which generates some 300,000 ideas and tens of millions a year into an innovation movement. The massive numbers here provide great potential of finding real gems of ideas. The recently appointed Chief Innovation Officer at Deputy Secretary level,

supported by a defence management service organisation whose new mandate is organisation excellence and innovation, will be driving this movement very hard.

Chapter Three. "NCW Redefines Mathematics"

From Chapter Two, if you get it right, one of the greatest benefit is that you can actually have a much leaner force with the same or more capability. Literally, one plus one is greater than two. Basic algebra does not apply here. Of course, the more sophisticated in the audience today here would want to talk about the exponential relationships for example as described by Metcalfe but I am doing a Dummies' Guide, if you don't mind. Many would have read about the significant force multiplying capabilities seen in Ops Iraqi Freedom and Ops Enduring Freedom. There are probably specific numbers of force multiplication but perhaps these are classified and not available in the public domain.

But there are many experiments are being conducted around the world to determine the numbers related to this new algebra, some data of which is available.

The US Army for example did one experiment with a digitised division that had a network that was 48 times faster than the traditional division. The heightened battlespace clarity, increased situation awareness and information superiority over the OPFOR permitted the experimental force to conduct distributed, non-contiguous operations. The Division capabilities improved significantly.

For example, quicker planning. Division-level plan development, the time for division level planning was reduced by 600%, from 72 hours to 12 hours.

Ops tempo was heightened. Time required for processing fires for fire reduced from 3 minutes to 30 seconds.

Planning time for deliberate attacks at the company was cut by half.

We have also been working on experiments to find such answers. For example, a series of experiments, the final phase of which we did in Australia as part of a large Army exercise, sought answers as to how much better a brigade can be if it were to be equipped with a suite of IKC2 capabilities. Some of the tools are as follows:

Visualisation tools to see the terrain to create superior appreciation of the ground situation.

Mobility devices like these PDAs which enabled more ground commanders to have improved situation picture and information.

Blue force trackers.

Use of recognition primed decision making methodologies to speed up understanding of the battlefield. Gary Klein would be pleased with this!

Collaboration tools, including Voice over IP technologies.

The brigade demonstrated clearly that with network and sensor technologies, they were able to achieve:

Large battlespace dominance

Superior operational tempo

Enhanced lethality; and

Enhanced survivability.

For example, there were instances that the suite of IKC2 tools could reduce the size of the brigade HQ by more than half.

We would continue to experiment with IKC2 tools next few years to examine where the greatest pay-offs would be so that we will know where the focus for the network build-ups should be.

Chapter Four. "Play with Lego"

I played with Lego as a little child; I am playing Lego again with my children. There is a good lesson for us here in this game. It involves many little bricks that can be put together to build all kinds of things. It embodies that idea of true flexible systems.

In Singapore, we were pushing for IT systems in 80s and early 90s. There were many systems built, some of which were state-of-the- art then. But today, if you look at the HR systems alone, this is the picture. It is incredibly complicated. Can you imagine throwing the many more systems in the other functional areas in too?

We think that for networks to work, we need to redesign our networks. We need to deconstruct first before constructing the system of systems. Like the game of Lego, we need modular pieces so that we can create flexible systems.

Everything from now onwards must be approached from an architectural perspective. We want to embed flexibility into our systems.

We are experimenting with the architecture. We think the use of service based architectures is probably the way to go.

These are some slides for our architectural strategy for our command and control systems, just to give you a feel of the ongoing efforts. For this, each piece of the C2 system is deconstructed into component services that can be fitted into the overall system.

Chapter Five. "Bet on People"

Tell you another story. It has a local flavour and for some of our foreign friends, perhaps the Singaporeans can help clarify some of the local nuances during the tea break.

"An incident took place at Boat Quay. An idiot declared that he would swim across the Singapore River. But before he could reach the halfway mark, he started to panic and shouted for help. A crowd soon gathered but no one made any effort to save the chap. Suddenly there was a splash and the crowd turned to see a young man in what seemed like a desperate attempt to reach the drowning victim. Somebody shouted, "Go Ah Beng, go!" But it was becoming clear that our hero Ah Beng cannot swim! What bravery! Luckily a tongkang was passing by and picked both men from the water. Back on shore, the crowd cheered as the hero stepped off the tongkang. Cheers of "steady lah, Ah Beng!" were heard But the hero appeared angry. Glaring at them, Ah Beng shouted "Bloody hell! Siang too lim peh loh chui?"

For our foreign friends, this is translated into 'Who pushed me into the water?"

What is going on here?

No ownership. The question is who is responsible for saving the poor chap.

The question we asked ourselves is who is responsible for innovation? Who is responsible for the transformation? And we decided that the answer must be everybody in the SAF.

But to have everybody involved, we need to put in place the foundations.

For example, we need to revisit how officer training should be conducted in the new world of IKC2.

We established a Centre for Leadership Development about one year ago. This centre would spearhead leadership development changes that need to be put in place in this new millennium.

At the same time, a major review is underway to look at how the SAF officer training institute should organised and what its responsibilities for training and education should be.

Next, we think that technology education is critical for RMA. We have started a scholarship system to send officers overseas for technology education – to the best engineering schools like Stanford and MIT and to specialist defence engineering schools like the Naval Postgraduate School.

At home, we have created a technology school called the Temasek Defence Systems Institute with partners from the National University and the Naval Postgraduate School to provide education at the masters level. At any one time, on average the institute has up to 60 students, including students from US, a year.

We have also revamped the technology content for all SAF courses and introduced a diploma level, 6-month technology course for the command and staff course.

We are trying to make the SAF a Learning Organisation. Some 2000 officers have gone through LO programmes in one form or another. The number of discussions that has used LO as a process has spawned exponentially as we built up these numbers.

We are betting that it is the people who will make IKC2 a reality.

Well, so much for the five chapters. There are many more chapters that can be shared, many more being written and even more still not being even conceived.

NCW, IKC2, NEC or any of their incarnations is going matter much much more than the aircraft or tanks or ships that can be bought. Everybody who is serious about building up an edge in their armed forces must strive to understand and implement it. Ignore it at your own peril.

In Singapore, we believe that we need to transform into a force based on IKC2. Why transformation is an imperative for us is another whole presentation in itself. The bottom-line is that we believe that we need to transform into a force that is flexible, a force that is able to deal with uncertainty and be able to do more with less.

But the reality is that to transform an armed forces into one that fully exploits networks is tough and I suspect that not all armed forces embarking on such efforts will succeed. In Singapore, we definitely think the journey will be very difficult. But we believe we may just have some chance as we are inherently paranoid. This paranoia has ensured that Singapore survived and prospered against many odds. We are therefore working hard on this transformation. Being small, we may also be able to be more agile and transform quickly and less painlessly. Our short history means that we do not have to worry about millions of years of tradition, beliefs and turf to fight with.

Today, I hope that my little introduction, followed by the more detailed presentations behind me, and the experts who will speak after me, would help clarify the language a little more. But before I finish, I would add on to this clarification in language from another angle. I am going to recite a little poem written about IKC2 and networks by one of my creative officers – in Chinese.

超音战机确能干
坦克一出敌军让
海中潜艇也很棒
但科技发展震 叹
未来什么模样?
让我试着来展望:
战场风云有新宝
网 络系统预知早
掌握敌情防备好
无人操机不可少
精准导弹靠得牢
全面攻击敌军倒
准确工效可把敌人
炸得呱呱叫,呱呱叫