Continuous Transformation of Battle Command
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The problem

 Good morning.
 They say that the first step toward overcoming a problem - is to admit that you
have a problem. Well, here I am, telling you "I've got a problem".

 My problem is - we've spent a heck of a lot of money on things called "decision
aids" for commanders, and they almost never get used.
 Howcome? I think there are three reasons: tactical innovation, brittle software,
and rigid interfaces.

 Here's some context.
 Last spring, our combat commanders demonstrated a compelling concept of what they
now call "overmatching power".
 To me, this means marshalling forces in specific areas, and at precise times, to
achieve military objectives rapidly and decisively.
 But to achieve the operational capability of "overmatching power", they need a
technical capability that I'll call "agile synchronization".
 Agile means we leverage unexpected opportunities, or counter unexpected threats, as
soon as they appear.
 Synchronization means that everybody contributes, but nobody get's in the way of
anyone else.

 Now, the US military has known for a long time how to achieve synchronization.
 Think about Gaum.
 Normandy.
 Kuwait.
 Iraqi Freedom.
 But these historic achievements involved thousands of people, laboring for weeks or
even months ahead of time.
 They weren't exactly agile.

 We saw a very different concept during operations against the Taliban in 2001.
 In the battle for Mazir-e-Shariff that November, agility ruled.
 B-52's provided on-call close air support.
 F-18's supported cavalry charges.
 Predators provided real-time video to gunships.
 We won a very unconventional conflict, because our forces were able to be agile -
they invented, in the field, novel tactics to exploit novel opportunities.
 But in this case, synchronization was easy, because the optempo of that conflict
was relatively low.

 So my goal today is to achieve both agility and synchronization.
 We can't do this by making our commanders and staff work harder - they already go
without sleep way too often.
 We can't make our staffs bigger - they're already huge, expensive, and hard to
protect.
 So it's time for automation to do something.

 But my problem today is that automation has been tried before - many, many times
before - with a spectacular lack of success.
 Go to any command center, and you'll see lots of computers, but what are they
doing? PowerPoint.
 Excel.
 Chat rooms and instant messaging.
 You may see some forms-driven databases, some web browsers, maybe even a 3D
fly-through.

 You won't see much sophisticated automation.

 Why? Why have most attempts to introduce automation into command centers failed in the field? I think three things limit our ability to automate battle management.

 The few decision aids that are in use today - the successful ones - address problems that are shaped by the laws of physics.
 For example, some aircraft use route planners to optimize time and fuel, and even minimize detectability.
 The physics of flight and sensors are well known, and have remained pretty stable over the years.
 Labs full of wind tunnels and anechoic chambers and turntables have made billions of measurements to construct models of physics, models from which we can derive good algorithms.

 But the driving factor behinds battle management is tactics, not physics.
 Think of a platoon of dismounted soldiers.
 Or a four-ship of F-15/Es.
 Or a naval battle group.
 Yes, there are physical limits to the mobility and endurance of these platforms.
 But the tactics, techniques, and procedures that shape their operations are based on a much richer set of ideas than maneuverability and endurance.
 Ideas like shock.
 Like deception.
 Like "centers of gravity".
 Like second- and third-order effects.

 So the first barrier is: we're dealing not with laws of physics, but with concepts of tactics.
 How do we build models of tactics? We have excellent textbooks, very realistic training devices, and a wealth of case studies, but that's just not enough to guide the development of tactics-driven automation.
 Galileo didn't build his models of gravity by listening to stories about balls falling from towers; he made models from measurements.

 So my first plea is for ideas about how we can build models of tactics.
 These will be extremely complex - they'll reflect training regimens, operating practices, historical lessons, and service traditions.
 The best we can do now is to have commanders who understand tactics talk with engineers who understand automation.
 Why not go for real data? Why not tie models directly to field data, instead of personal memories?
Second: Tactics change faster than software

 There's another problem, though.
 Most technology to automate battle management ends up as software.
 And because the technology is complicated, the software is complicated.
 How long does it take to deploy or upgrade this software? At best months, sometimes years.

 Well, the hard fighting in Operation Enduring Freedom was over in three months.
 Operation Iraqi Freedom in two.
 And in both, tremendous changes in tactics took place during the operation - all due to the spirit of innovation of our deployed personnel.
 That's great for the country, but not so great for our software.
 If folks in the field come up with new tactics every day, but our factories take months to update software products, then our decision aids are obsolete a week after the war starts.

This is why our command staffs set their heavy automation aside, and go to more flexible, if simpler, tools.
Like PowerPoint and Excel.

So the second barrier is that, in conflicts where it matters, the pace of tactical innovation far exceeds the pace of software fabrication.
So tools become obsolete.

My second plea, then, is for ideas that allow us to make deployed software much more adaptive.
As a control engineer, I believe that feedback is a crucial part of the solution.
We need to know what's happening in the field.
How can we monitor what's really going on? How can we discover new tactics as they arise? That's what we need to do to keep our tools relevant.

Our Armed Services do not train commanders to wait for the enemy to come to us.
Initiative is vital.
Good commanders make the enemy conform to our objectives, not us to theirs.

To many, automation is just another enemy.
Field personnel rarely have the desire, or patience, to adjust their styles to suit that of our software.
If software gets in their way, their natural inclination is to kill it, not to conform to it.

I think this is actually the way things should be.
Technology should serve military needs, not constrain them.
A decision aid that requires three screens of data, expressed in a 9-point font, with three levels of popup menus, is no aid at all.

So the final barrier is complexity.
Most operational folks that I've met think in terms of time and space and flow and relationships and patterns, not the numbers and equations and text that get built into software.

My final plea, then, is for ideas on how operational folks can interact with complex algorithms in a way that is natural for them.
Ways that clearly relate to mission objectives.
Ways that permit intuitive manipulations of graphical structures that connect commanders' intent with operational concepts like space and time and networks, not tab-delimited fields and icons.

So now you know what my immediate problem is - we've spent a heck of a lot of money on things called "decision aids" for commanders, and actually achieved very, very little.
Because we don't know how to deal with tactical innovation, brittle software, and rigid interfaces.

But there's a longer-term challenge, too.
Yesterday you heard how my friends in TTO are building ever-more-capable autonomous platforms.
And how my friends in ATO are building ever-more-capable networks to tie them together.
Once they're tied together, we're going to face a truly awesome technical challenge: command and control of robotic forces.
No, I don't mean the silly machines from Star Wars - I mean tactically savvy squads of robots that use agile synchronization to shock, deceive, and overwhelm our opponents' centers of gravity.
The question is not "if", but "when" this will happen - and I'd really appreciate

your help making the "when" become "soon".

 Thank you for listening to my problems.
 If automated battle management isn't your field, don't worry, my colleagues in IXO
have lots of other problems.
 And I'd like to recall Ted to the stage to remind you you desperately we need your
help.
 Thank you.