



Teaching Command and Control Systems at West Point



Presented at 12th International Command and Control Research and Technology Symposium



Department of Systems Engineering

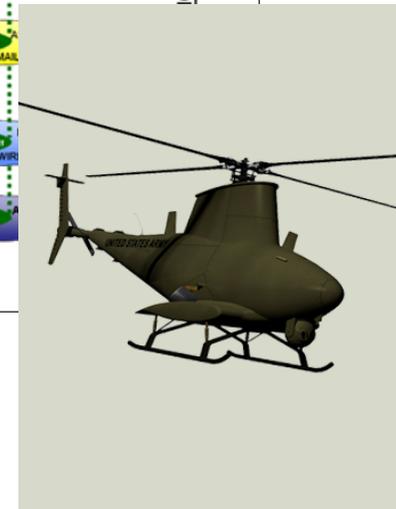
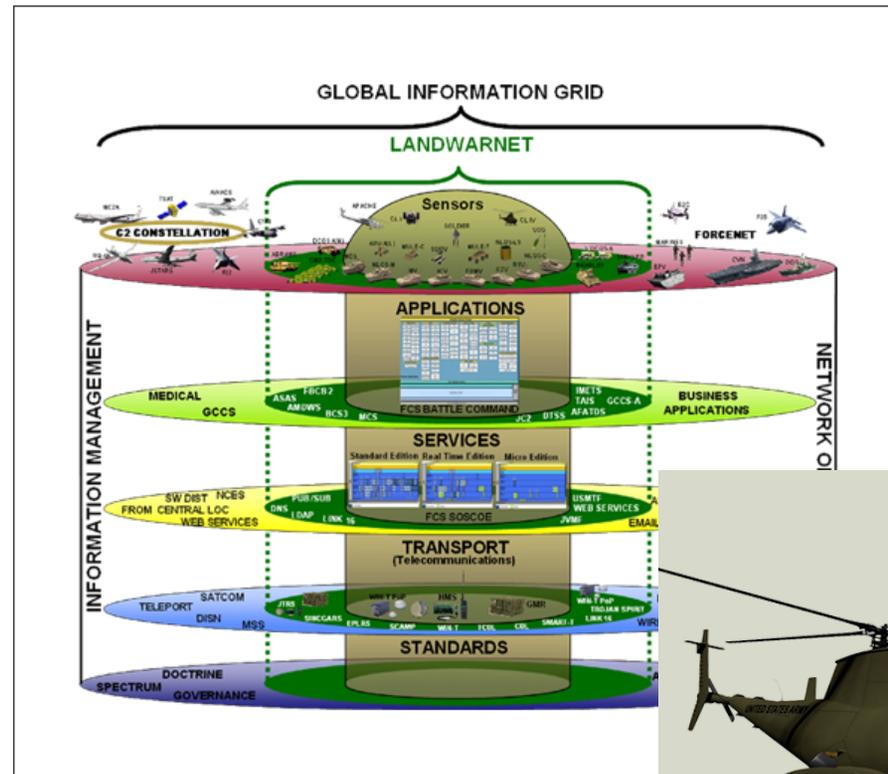
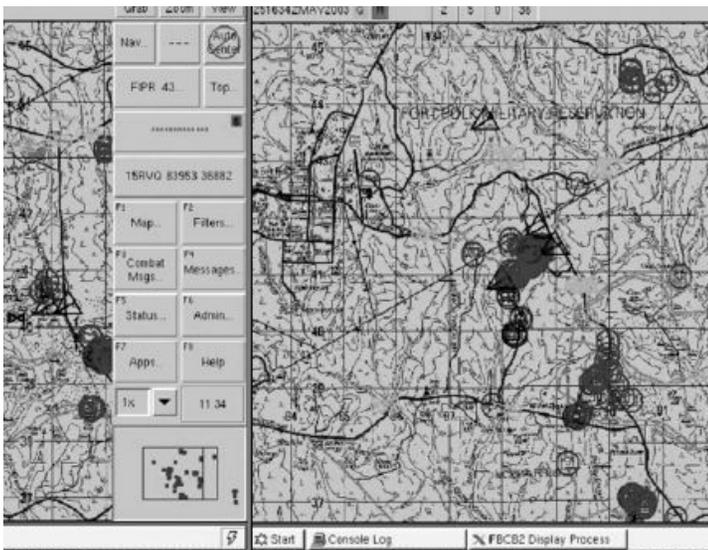


'The Army's Systems Engineering Department'

Educating cadets, officers and the Army leadership on Systems & Engineering Management concepts vital for success in a complex and uncertain world.



A Changing Military Environment





Course Overview



- **Purpose – Better prepare cadets for command and control challenges they will face as company grade Army officers.**
- **Course Hypothesis:**
A trained and cohesive organization enabled by well-designed collaborative command and control systems will be able to apply decentralized command and control processes in order to increase unit agility and gain a tactical advantage as compared to units that are less collaborative and more centralized.



Course Objectives



- **Analyze the information age hypothesis that a trained and cohesive organization enabled by well-designed collaborative command and control systems will be able to apply decentralized command and control processes in order to increase unit agility and gain a tactical advantage as compared to units that are less collaborative and more centralized.**
 - **Apply information age command and control concepts to the design and implementation of a command and control system. These include globalization, mission command, agility, self-synchronization, and power to the edge.**
 - **Using available technology, design information based command and control systems to maximize mission effectiveness.**
 - **Apply network, data, and interoperability engineering concepts to the design and implementation of a command and control system.**
 - **Identify specific decision processes and define command and control capabilities which best support those decisions.**
 - **Estimate the value gained by using a specific command and control system with specific capabilities.**
 - **Re-engineer unit organization and processes to best take advantage of capabilities provided by a command and control system.**
 - **Become familiar with the use of Army Battle Command Systems to command and control Army and Joint tactical operations.**
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-



Approach



- **Hands on experience**

- Command and control lab exercises
- Simulation software
- In-class collaboration exercises
- Command and control portal design

- **Critical thinking and analysis**

- Analysis of Army and Marine command and control approaches in Operation Al-Fajr (Fallujah)
 - Topic briefings
 - Command and control case study
 - Synthesis paper
-
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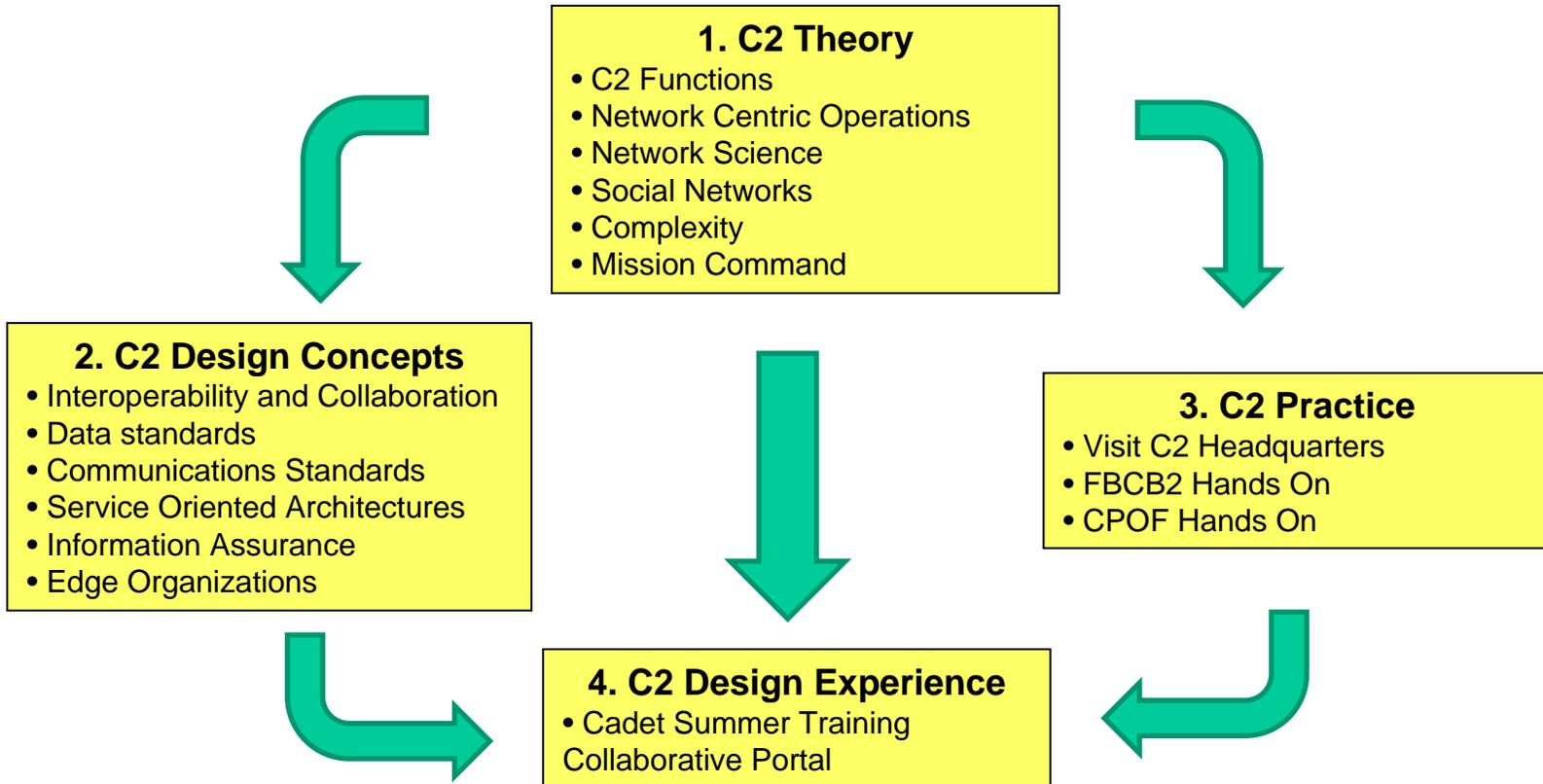
Textbooks



Authors	Title
David Alberts and Richard Hayes	Power to the Edge: Command and Control in the Information Age
David Alberts and Richard Hayes	Understanding Command and Control
Atkinson, Simon Reay and James Moffat	The Agile Organization
Headquarters, Department of the Army	FM 6-0, Mission Command: Command and Control of Army Forces



Course Structure





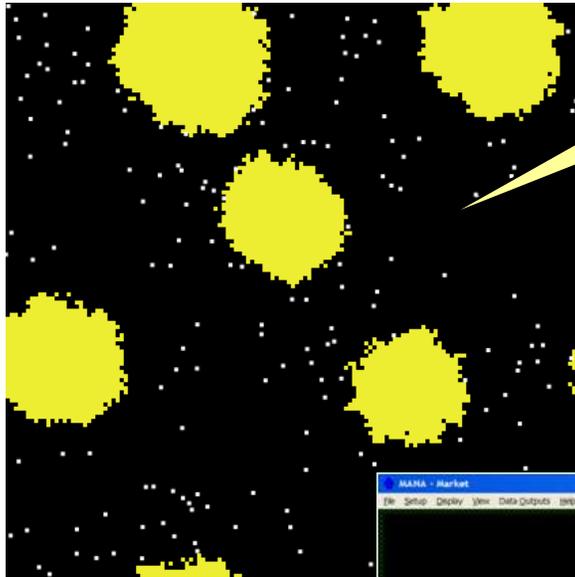
C2 Theory



- **Command and control functions**
- **Industrial age command and control**
- **Complexity and self organization**
- **Swarming on the battlefield**
- **Mission command**

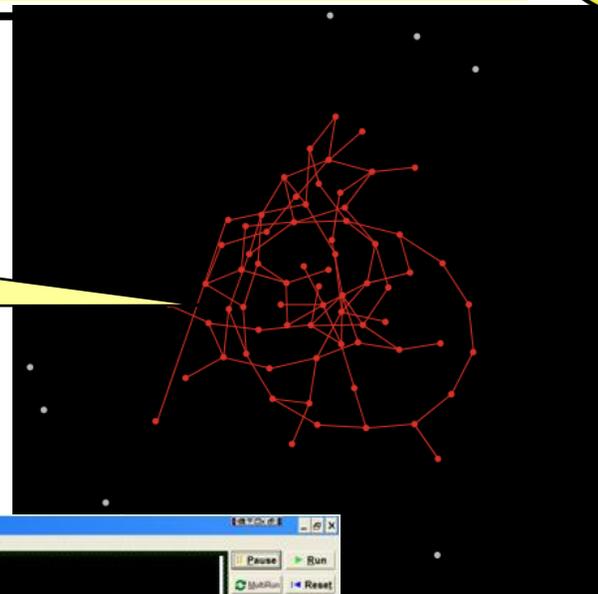


Agent-Based Modeling Exercises

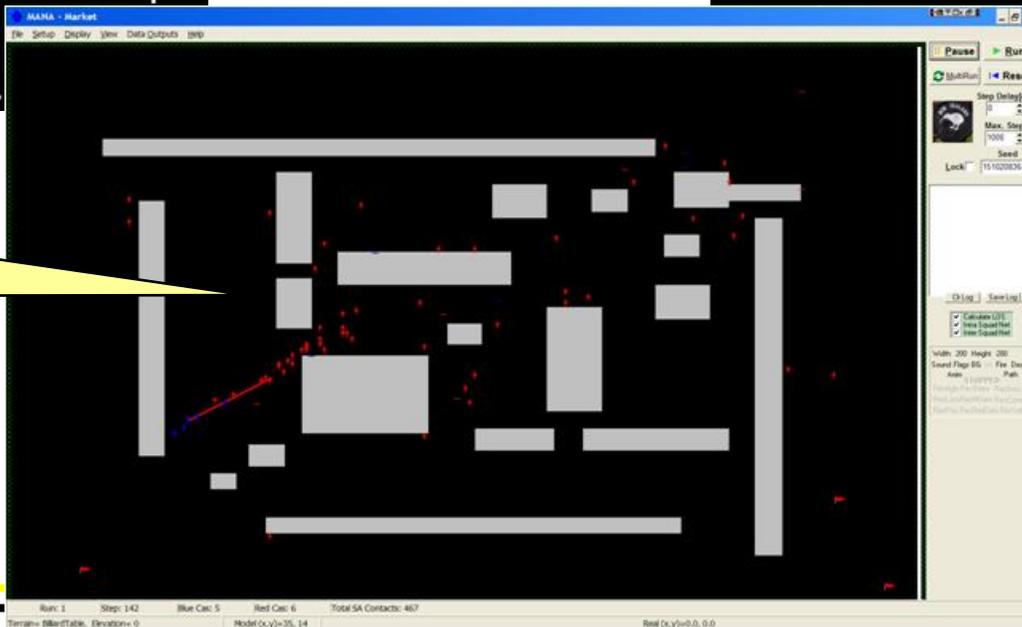


Netlogo
Complexity

Netlogo
Network Stats



Mana
Self Organization
Swarming





Empire Earth II Command and Control Exercises





Mission Command



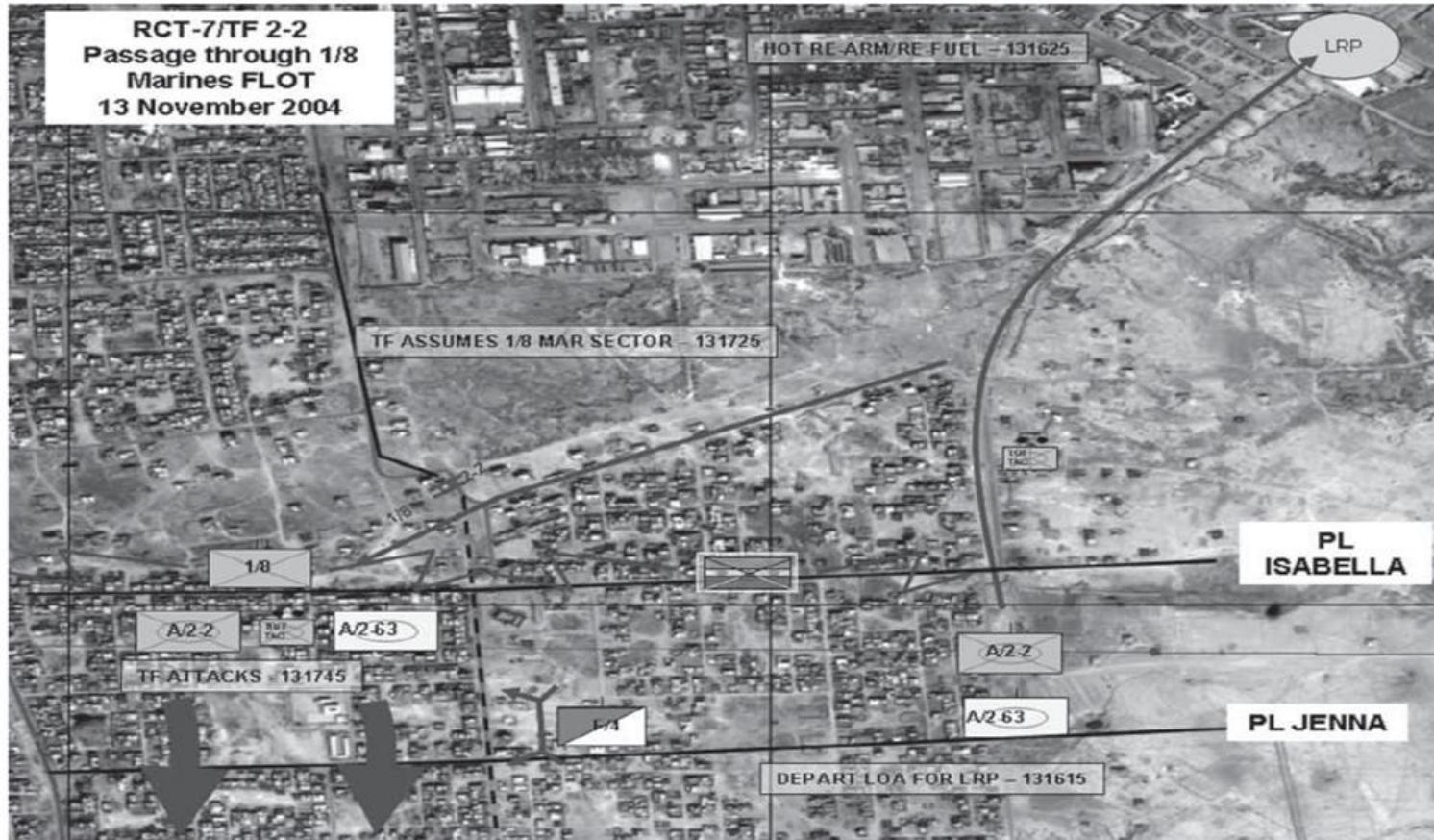
<ul style="list-style-type: none"> • Probabilistic • Unpredictable 	Assumes war is	<ul style="list-style-type: none"> • Deterministic • Predictable
<ul style="list-style-type: none"> • Disorder • Uncertainty 	Accepts	<ul style="list-style-type: none"> • Order • Certainty
<ul style="list-style-type: none"> • Decentralization • Spontaneity • Informality • Loose rein • Self-discipline • Initiative • Cooperation • Acceptable decisions faster • Ability all echelons • Higher tempo 	Tends to lead to	<ul style="list-style-type: none"> • Centralization • Coercion • Formality • Tight rein • Imposed discipline • Obedience • Compliance • Optimal decisions, but later • Ability focused at the top
<ul style="list-style-type: none"> • Implicit • Vertical and horizontal • Interactive 	Communication types used	<ul style="list-style-type: none"> • Explicit • Vertical • Linear
<ul style="list-style-type: none"> • Organic • Ad hoc 	Organization types fostered	<ul style="list-style-type: none"> • Hierarchic • Bureaucratic
<ul style="list-style-type: none"> • Delegating • Transformational 	Leadership styles encouraged	<ul style="list-style-type: none"> • Directing • Transactional
<ul style="list-style-type: none"> • Art of war • Conduct of operations 	Appropriate to	<ul style="list-style-type: none"> • Science of war • Technical/procedural tasks

Figure 1-4. Concepts of Command and Control



Theory Exam

Operation Al-Fajr (Fallujah)



Credited to Lieutenant Colonel John Reynolds



C2 Design Concepts



- Interoperability and Collaboration
- Data standards
- Communications Standards
- Service Oriented Architectures
- Global Information Grid and LandWarNet
- Information Assurance
- Edge Organizations



Advantages of Standards

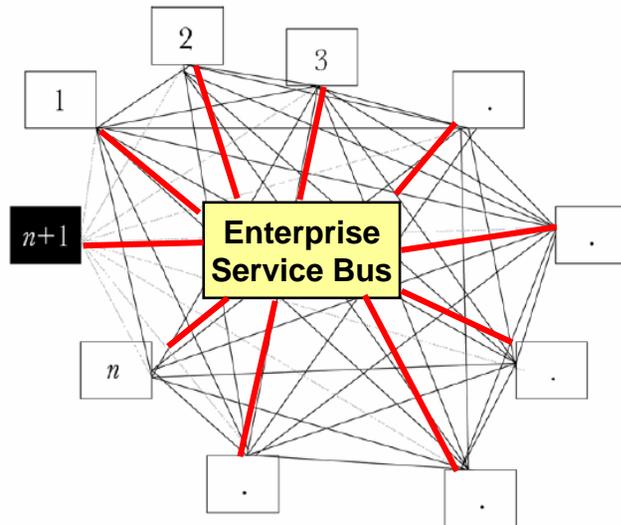
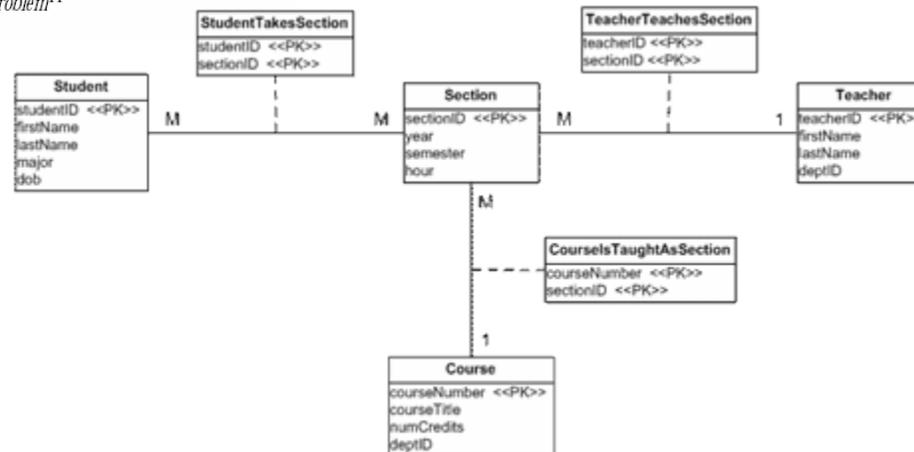


Figure 16. An n^2 Problem¹¹

- **Application to application integration**
 - 55 integration projects
- **Standards based integration**
 - 10 integration projects
- **Better alignment with C2 processes**

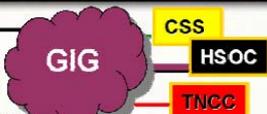
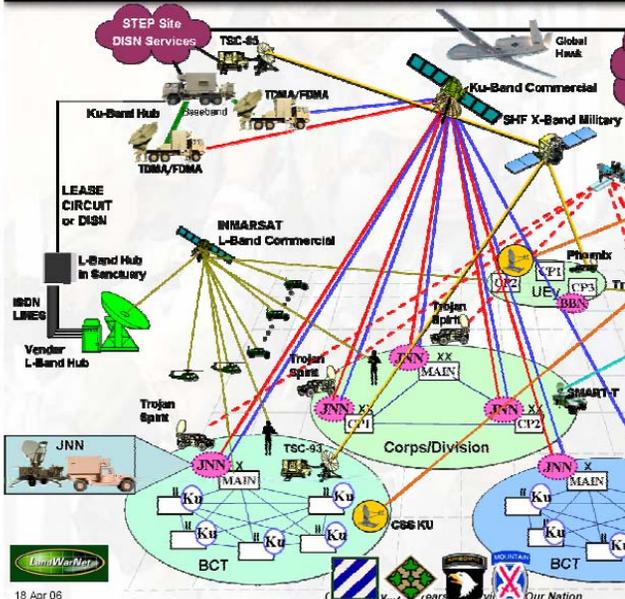




LandWarNet



LandWarNet: JNTC - S



The Joint Model - Everything over IP

- FIRST ... the Joint Special Operations Command - Fort Bragg
- THEN the Joint Communications Support Element - MacDill AFB
 - Iraq
 - Afghanistan
- NOW!!!

- Everything over Internet Protocol
 - Scalable
 - Flexible
 - Efficient
 - Less cost, smaller footprint, less people.
 - EoIP will converge & reduce training requirements



JOINT COMMUNICATIONS SUPPORT ELEMENT
 To address inefficiencies of traditional bandwidth allocations.....migrate everything to EoIP



Edge Organizations



	Hierarchies	Edge Organizations
Command	By directive	Establishing conditions
Leadership	By position	By competence
Control	By direction	An emergent property
Decisionmaking	Line function	Everyone's job
Information	Hoarded	Shared
Predominant Information Flows	Vertical, coupled with chain of command	Horizontal, independent of chain of command
Information Management	Push	Post - Pull
Sources of Information	Stovepipe monopolies	Eclectic, adaptable marketplaces
Organizational Processes	Prescribed Sequential	Dynamic Concurrent
Individuals at the Edge	Constrained	Empowered

Figure 29. Comparison of Attributes of Hierarchies and Edge Organizations



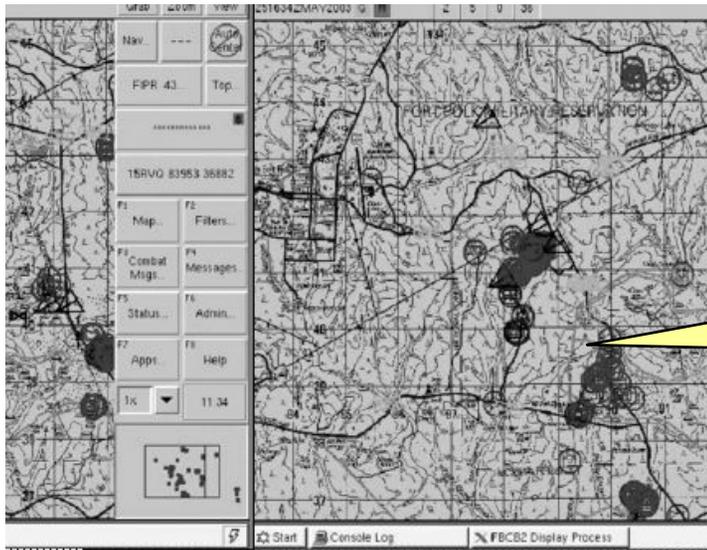
Hands on C2



**Field Trip
Hudson Valley
Transportation
Management
Center**



Artist Rendering of Future TMC Control Room



**In-Class FBCB2
Command and
Control Exercise**



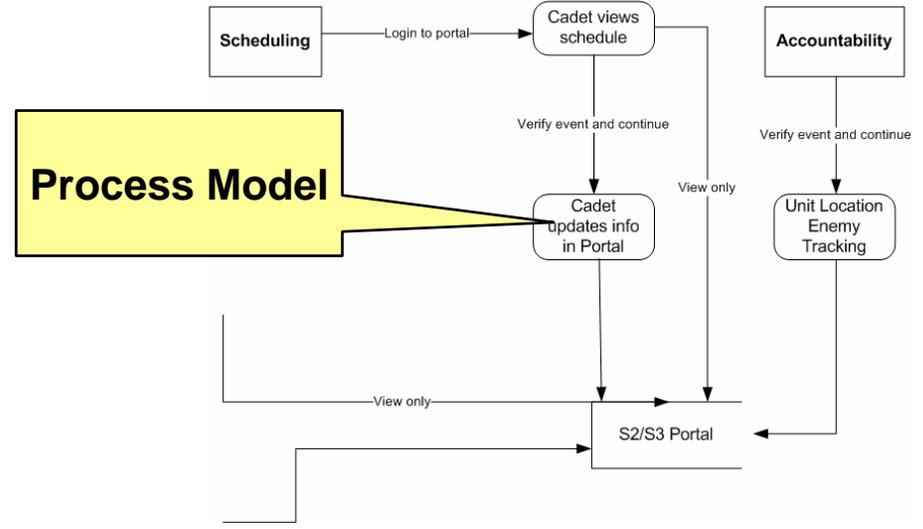
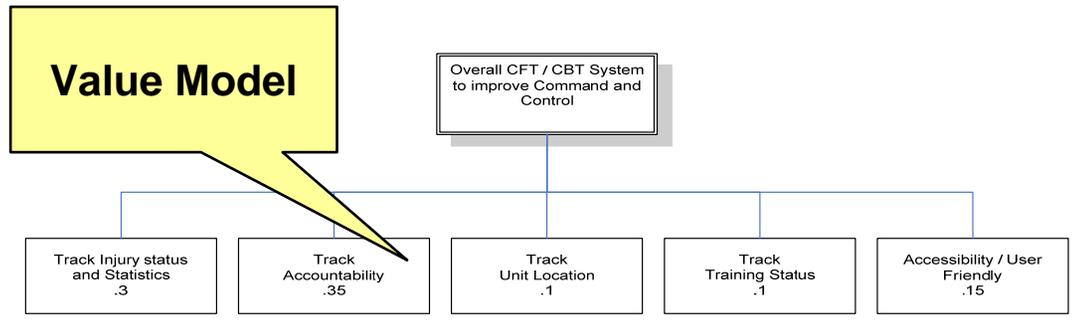
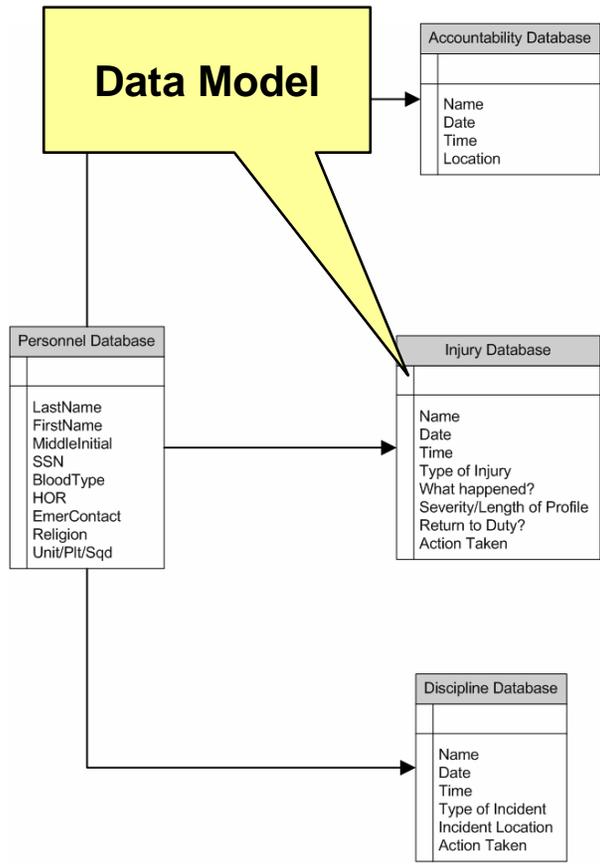
Cadet Summer Training C2 System Design Exercise



- Realistic design exercise
- Elicit requirements from real stakeholders
- Build value model, process model, data model
- Design system as a web portal
- Identify how users can use system to empower individuals in the organization
- Present system to actual users
- Plan for implementation



CFT C2 System Design





Cadet Field Training Portal



Home - Cadet Field Training - Microsoft Internet Explorer

Address <http://usma-portal/collab/se/CFT07/default.aspx>

Welcome Kewley, Robert LTC SE | My Site | My Links

Cadet Field Training

Home | Cadet Basic Training Portal | SE490 Design Page | **Cadet Field Training** | Site Actions

View All Site Content

Regimental Staff Pages

- Command Page
- S1 - Personnel
- S3 - Operations
- S4 - Supply

Documents

- Command Documents
- S1 - Personnel
- S3 - Operations
- S4 - Supply
- CSM Page

Lists

- Calendar
- Training Status
- Unit Location
- Company Level Request System
- RFI Log
- Task Listing
- Lessons Learned
- S3 Links
- Work Orders
- CFT1 Accountability Master

Pictures

- CBT 2007 Pictures

Discussions

- Team Discussion
- Feedback Discussion

SE Collaboration > Cadet Field Training

USMA Cadet Field Training 2007 Command and Control Portal

Command Announcements

CFT 07 Command and Control Portal Operational 5/21/2007 12:59 PM
by Kewley, Robert LTC SE
The CFT Portal is operational. Please refer to your appropriate staff page and document library for example databases and lists.

Add new announcement

Calendar

New | Actions | Settings

May, 2007 Expand All Collapse All 1 Day 7 Week 31 Month

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26 Eric Goes Home!!

Links

- USCC Internal
- USCC S1
- USCC S3
- USCC S4
- Local Weather

Add new link

Done Local intranet



The Future



- **Course is now integrated into USMA Curriculum**
- **Planning to introduce Command Post of the Future (CPOF) lab exercise**
- **Planning to find away to assess C2 designs using simulation**
- **27 students enrolled for Fall 2007**