REQUIREMENTS PROCESS

NEW CHALLENGES FOR DEFENSE ANALYSIS

VINCE ROSKE
DEPUTY DIRECTOR, J8
(WARGAMING, SIMULATION, & ANALYSIS)
THE JOINT STAFF

BRIEFING OUTLINE

- **BILL COSBY QUOTE. "CONTROL"**
- **THE LANGUAGE OF THE DEFENSE DEBATE**
- **A PROBLEM FOR ANALYSTS.**
  - **SYSTEMS WE CONTROL**
  - **SYSTEMS WE DO NOT CONTROL.**
- **COMPLEXITY SCIENCE**
- **AGENT BASED SIMULATION**
  - **THE ROLE OF THE TEST- BRITS EXAMPLE**
  - **"LEARNING/ ADAPTING AGENTS**
- **EMERGING NEW ROLE FOR THE ANALYST.**
- **CHALLENGES**

SHAPING THE CORE OF DEFENSE ANALYSIS

- **NEWTON'S IMPACT ON ANALYSIS.**
  - **PREDICTABLE CAUSE AND EFFECT.**
  - **THE WORLD AS A SYSTEM OF SYSTEM**
- **THE INDUSTRIAL REVOLUTION'S CONFIRMATION.**
  - **WE ARE IN CONTROL.**
- **THE ROLE OF THE ANALYST.**
  - **DEFINE THE ISSUE PROCESS AS A SYSTEM.**
  - **CALCULATE THAT SYSTEM'S BEHAVIOR.**
  - **EXPLAIN THE SYSTEM'S BEHAVIOR IN WAYS USEFUL TO A DECISION MAKER.**

THE EMERGING NEW FRONTIER OF ANALYSIS

- **WHAT IF WE ARE NOT IN CONTROL?**

- **IS THE "SYSTEM" WE SEE DEFINE REPRESENTATIVE. OF REALITY ? OR IS IT:**
  - **INFERRED FROM OUR AVAILABLE CALCULUS.**
  - **THE CURRENT STATE OF A TRANSIENT BEHAVIOR?**

- **WHAT IS REALLY KNOWABLE ABOUT "REALITIES"?**
  - **HOW DO THEY REALLY BEHAVE??**

- **WHAT MAKES SENSE TO DO ABOUT THEM ?**
  - **CAN WE TRUST OUR NEWTONIAN PARADIGM??**

LISTEN:

TO THE LANGUAGE OF THE DEFENSE DEBATE.

THE LANGUAGE OF TODAY'S DEFENSE DEBATE

- "ADAPTIVE" THREATS.
- "EFFECTS BASED" OPERATIONS.
- VALUE OF C4ISR?
  - THE VALUE OF INFORMATION.
- TRANSFORMATIONAL FORCES
- SELF-SYNCHRONIZING ARCHITECTURES.

- EMERGENT STRUCTURES.
  - WE ARE ADMITTING THAT:
    - WE ARE NOT IN CONTROL OF "THE SYSTEM."
    - WE ARE DEALING WITH SYSTEMS THAT WE EXPECT WILL CHANCE THEMSELVES TO SURVIVE AND DOMINATE.

THE EMERGING ANALYSIS PARADIGM

- **COMPLEXITY SCIENCE.**
  - **"OPEN" SYSTEMS**
    CONDITIONS FOR SELF ORGANIZATION
    - **"ORDER FOR FREE".**

- **AGENT BASED SIMULATION.**
  - **"DOT WARS" AND LEARNED ADAPTATION.**

- **THE ROLE OF THE COMPUTER.**
  - **THE ROLE OF "THE TEST".**

- **THE ROLE OF THE ANALYST.**

COMPLEXITY SCIENCE

COMPLEXITY PROCESSES WITH EXPRESSION IN TODAY'S DEFENSE DEBATE.

- **CHAOS.**
- **FRACTALS**
- **SELF ORGANIZATION.**
- **COMPLEX ADAPTIVE SYSTEMS.**
- **EMERGENT BEHAVIOR.**
- **CO-EVOLUTION**
  - **ON CHANGING FITNESS LANDSCAPES.**
  - **ATTRACTORS**
- **DATA FARMING.**

NAVY POST GRADUATE SCHOOL SYLLABUS

AGENT BASED SIMULATION

"IS A"

- LOTS OF AGENTS INTERACTING.
  - FOLLOWING THEIR INDIVIDUAL RULES
  - SATISFY THEIR OWN NEEDS
  - DOING THEIR OWN THING.

- GROUPS OF AGENT ACTORS (DIFFERENT KINDS) :
  - ASSEMBLE THEMSELVES.
  - EXHIBIT EMERGENT BEHAVIORS.
    - AS A GROUP.
    - AS INDIVIDUALS.

AGENT BASED SIMULATION EXAMPLES

TRANSIM - LOS ALAMOS NATIONAL LABS
METROPOLITAN TRAFFIC BEHAVIOR

MANA- NEW ZEALAND MOD
SMALL UNIT TACTICS

PROJECT ALBERT- USMC
SMALL UNIT TACTICS

COUNTER DRUG MODEL- ARGONNE NATIONAL LAB
- **ARCHITECTURE DESIGN AND MANAGEMENT**
- **OPERATIONAL AND SYSTEMS LEVEL.**

ROLE OF THE COMPUTER

- **TRADITIONAL ROLE: (CLOSED SYSTEMS)**
  - **COMPUTE A CALCULUS WE DEFINE FOR A SYSTEM.**
    - **FAST SLIDE RULES.**
      - **CALCULATE**
      - **ITERATE**

- **NEW ROLE: (OPEN SYSTEMS)**
  - **EVOLVE ASSEMBLIES OF AGENTS TO ACCOMPLISH A PERFORMANCE GOAL, A TEST.**
  - **DISPLAY THE AGENTS' BEHAVIORS.**

EVOLVE AGENTS AND ASSEMBLIES OF THEM THAT BEST ACCOMPLISH THE TESTS WE PRESCRIBE - EMERGENCE

BRITISH RESEARCH EXAMPLE

ROLE OF THE ANALYST

- **TRADITIONAL ROLE:**
  - **TRANSLATE THE ISSUE INTO A SYSTEM.**
  - **PRESCRIBE A CALCULUS TO REPRESENT THE SYSTEM AND ITS PERFORMANCE.**
  - **PREDICT THAT SYSTEM'S BEHAVIOR.**

- **NEW ROLE:**
  - **DEFINE THE INVOLVED AGENTS**
  - **DEFINE A CALCULUS FOR EVOLVING THEIR CHARACTERISTICS AND ASSEMBLY.**
    - **GENETIC ALGORITHMS**
  - **DEFINE THEIR "TEST" (PERFORMANCE GOAL)**
  - **OBSERVE THE EMERGENT BEHAVIOR (COMPUTER)**
  - **EXPLAIN THE BEHAVIOR TO A DECISION MAKER.**

SYSTEMS DYNAMICS EXAMPLE

CLOSING OBSERVATIONS

- **IF AN ISSUE INVOLVES "CLOSED" SYSTEMS: TRADITIONAL ANALYSIS METHODS MAY WORK WELL..**
  - **CLOSED = NO ENERGY CROSSING SYSTEM BOUNDARY**
    - **PERCEPTION, INITIATIVE, CREATIVITY=ENERGY**

- **IF AN ISSUE INVOLVES "OPEN" SYSTEM: TRADITIONAL ANALYSIS METHODS MAY NOT APPLY.**
  - **ENERGY MOVING INTO THE SYSTEM WILL ALTER THE CAUSE AND EFFECT RELATIONSHIPS.**
    - **C3ISR SYSTEMS , EBO, ADAPTIVE THREATS, ETC.**
  - **THE AGENTS ACTING IN THE SYSTEM WILL ADAPT & EVOLVE THEMSELVES AND THEIR RELATIONSHIPS TO SURVIVE AND DOMINATE.**
  - **OPEN SYSTEMS MORPH, LEARN, ADAPT, EVOLVE.**

CHALLENGES

- **WHAT IS THE VALUE OF ANALYSIS OF "OPEN SYSTEM" ISSUES PERFORMED WITH CLASSIC "CLOSED SYSTEM" METHODOLOGY?**

- **HOW DO WE RECOGNIZE THE ANALYSIS BOUNDARY BETWEEN OPEN & CLOSED SYSTEMS?**

- **HOW DO WE DESCRIBE& ANALYZE "OPEN SYSTEM" ISSUES?**

- **WHAT IS IMPORTANT TO KNOW ABOUT "OPEN" MILITARY SYSTEM BEHAVIOR?**

- **WHAT CAN WE TELL DECISION MAKERS ABOUT "OPEN" PROCESSES AND CONSEQUENCES?**

- **WHAT CAN WE LEARN FROM COMMERCIAL USES OF COMPLEXITY SCIENCE & OPEN SYSTEM ANALYSIS?**

- **WHAT IS THE "RIGHT WAY" TO USE THE COMPUTER?**