Analytic Metaphysics

Special Lecture:
Col. W. Mandrick, Terrorism, War and Warfighting

Lecture 11
April 19, 2016
Basic Formal Ontology: Accurate Descriptions of the Operational Environment

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University at Buffalo
Department of Philosophy
Special Topics
PHI 598Analytic Metaphysics
Tuesday 19 April 2016
Network Science for Situational Awareness

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Senior Fellow  
Center for Special Operations Studies and Research  
Joint Special Operations University
**Key Terms**

**Situational Awareness (SA)** —
Procedures for describing the operational environment, including threats to national security. This occurs during continuous monitoring of the national and international political and military situations so that JFCs and their staffs can determine and analyze emerging crises, notify decision makers, and determine the specific nature of the threat. (Joint Publication 5-0 Joint Operation Planning)

**Joint Operation Planning** —
Planning activities associated with joint military operations by combatant commanders and their subordinate joint force commanders in response to contingencies and crises. (Joint Publication 5-0 Joint Operation Planning)

**Targeting** —
The process of selecting and prioritizing targets and matching the appropriate response to them, considering operational requirements and capabilities. (Joint Publication 3-60 Joint Targeting)

**Target Audience** —
An individual or group selected for influence. (Joint Publication 3-13 Information Operations)

**Effect** —
1. The physical or behavioral state of a system that results from an action, a set of actions, or another effect.
2. The result, outcome, or consequence of an action.
3. A change to a condition, behavior, or degree of freedom. (Joint Publication 3-0 Joint Operations)
“We do not understand the movement, and until we do, we are not going to defeat it,” he said, according to the confidential minutes of a conference call he held with the experts. “We have not defeated the idea. We do not even understand the idea.”
3rd Order Reality:
The way we represent those nodes and links in 1st Order Reality (Common Operational Picture)

2nd Order Reality:
Our mental representations of 1st order reality (Situational Awareness)

1st Order Reality:
The actual nodes and links (relationships) in physical reality
What is a Network?

Network:

a system of people or things: a large and widely distributed group of people or things such as stores, colleges, or churches that communicate with one another and work together as a unit or system
What is a Social Network

Social Network:

a social structure made up of a set of social actors (such as individuals or organizations) and a set of the dyadic ties between these actors. The social network perspective provides a set of methods for analyzing the structure of whole social entities as well as a variety of theories explaining the patterns observed in these structures.[1]

The study of these structures uses social network analysis to identify local and global patterns, locate influential entities, and examine network dynamics.

Social networks and the analysis of them is an inherently interdisciplinary academic field which emerged from social psychology, sociology, statistics, and graph theory.

Wasserman, Stanley; Faust, Katherine (1994). "Social Network Analysis in the Social and Behavioral Sciences"
What is Analysis?

1. Analysis is the separating of any material or abstract entity into its constituent elements (opposed to synthesis).

2. this process as a method of studying the nature of something or of determining its essential features and their relations.
In network theory, **link analysis** is a (data-analysis) technique used to evaluate relationships (connections) between nodes.

Relationships may be identified among various types of nodes (objects), including organizations, people and transactions.

Link analysis has been used for investigation of criminal activity (fraud detection, counterterrorism, and intelligence), computer security analysis, search engine optimization, market research and medical research.
Social network analysis (SNA)

Social network analysis views social relationships in terms of network theory, consisting of nodes (representing individual actors within the network) and ties (which represent relationships between the individuals, such as friendship, kinship, organizations, sexual relationships, etc.) These networks are often depicted in a social network diagram, where nodes are represented as points and ties are represented as lines.
Creating Nodes and Links
(Asterisks indicate a leader performance step.)

Evaluation Preparation: Ensure that all information, references, equipment, and role players required to perform the tasks are available. Use the performance measures and the references to score the Soldier’s performance. Brief the Soldier. Tell the Soldier what he is required to do according to the task conditions and standards.

<table>
<thead>
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<th>PERFORMANCE MEASURES</th>
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<tr>
<td>GO</td>
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<tr>
<td>1. The Soldier gathered civil information from all available sources.</td>
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<td>2. The Soldier located elements of civil information from available sources across the following factors:</td>
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<td>a. Areas or places.</td>
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<td>b. Structures.</td>
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<td>c. Organizations.</td>
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<tr>
<td>d. People.</td>
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<td>e. Events.</td>
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<tr>
<td>3. The Soldier depicted each element of civil information identified above as a node.</td>
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<tr>
<td>4. The Soldier depicted any known or assumed link between the nodes as a line connecting the nodes.</td>
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Supporting Reference(s):

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<td>Capabilities</td>
<td>Organization</td>
<td>People</td>
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<td>Cemeteries</td>
<td>Sewer</td>
<td>Tribal</td>
<td>Phones</td>
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<td>Families/Clans</td>
<td>Religious shrines</td>
<td>Water</td>
<td>Family/clan</td>
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<td>Electrical</td>
<td>Religious</td>
<td>Face-to-face</td>
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<td>Religion</td>
<td>Bars/tea shops</td>
<td>Academic</td>
<td>Ethnic</td>
<td>Media/radio</td>
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<td>Economic districts</td>
<td>Social gathering places</td>
<td>Trash</td>
<td>US/coalition forces</td>
<td>Media/TV</td>
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<tr>
<td>Smuggling routes</td>
<td>Print shops</td>
<td>Medical</td>
<td>Governmental agencies</td>
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<td>National</td>
<td>Internet cafes</td>
<td>Security</td>
<td>Farmers or Union</td>
<td>Visual</td>
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<tr>
<td>Social classes</td>
<td>Television</td>
<td>Market (use and goods)</td>
<td>Community</td>
<td>Visual (videos, DVs)</td>
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<tr>
<td>Political districts</td>
<td>Radio station</td>
<td>Employment and commerce</td>
<td>Military or militia units</td>
<td>Audio (pirated or illegal radio)</td>
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<td>Military districts</td>
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<td>Crime and justice</td>
<td>Illicit organizations</td>
<td>Railies or demonstrations</td>
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<td>Insurgent groups</td>
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<td>Dams</td>
<td>Public health</td>
<td>Gangs</td>
<td>Door-to-door</td>
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<td>Economic (jobs)</td>
<td>Businesses organizations</td>
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<td>Gas stations</td>
<td>Displaced persons and refugees</td>
<td>Nomads</td>
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<td>Military barracks</td>
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<td>Jails</td>
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<td>Labor unions</td>
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**FIGURE 3-2, CIVIL CONSIDERATIONS MATCHED TO ASCOPE**
### ASCOPE & PMESII

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<th>Areas</th>
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Sample Relations

- **professional_relation**
  - co-worker
  - subordinate_of
    - apprentice_of
    - employee_of
  - superior_of
    - commander_of
    - employer_of
    - leader_of
  - qualitative_relation
    - has_capability
    - has_function
    - has_quality
  - social_relation
    - acquaintance_of
    - adversary_of
      - enemy_of
    - associate_of
    - friend_of
    - member_of
  - temporal_relation
    - happened_at_date
    - happened_at_time
    - happened_on

- **data_relation**
  - denotes
  - describes
  - designates
  - expresses
  - expression_of
  - is_about
  - measurement_of
  - symbol_for

- **geospatial_relation**
  - co_located_with
  - has_location
  - located_at
  - located_near
  - vicinity_of

- **part_whole_relation**
  - has_part
  - overlaps_with
  - part_of

- **process_relation**
  - cause_of
  - caused_by
  - has_effect
  - has_output
  - produces
  - product_of
  - result_of
  - results_in

- **took_place_at**
Conclusions

• Currently Little (No) situational awareness/understanding of
  • Appeal of Violent Extremist Group messaging
  • Sentiment that motivates behaviors within Target Audiences
    • “… ideology that animates the terrorist movement…”
    • “…capacity for rallying young people to its radicalized version of Islam…”
  • ISIS’ main objectives
    • Ideological
    • Territorial

• Network Science and Social Media Analytics
  • Influential Persons and Organizations
  • Emerging Sentiments
  • Evolving Organizations
  • Critical Events
Foreign Fighters

COL Bill Mandrick, PhD
Senior Fellow
Joint Special Operations University
Foreign Fighters: Whose Problem is it?

- Complexity and Reductionist Staff Approaches
- Femtorisks
- Data Analytics for Social Media
- Countering Violent Extremism (CVE)
- Ontology of a Foreign Fighter
- Future of “Viral” Conflicts
- Conclusions
Complexity and Reductionist Staff Approaches in Stability Operations

- U.S. military often creates and operates off of dubious “facts”
- Once published or “hung” on a computer network they gain institutional significance
- Planning should be adjusted with new sets of hypotheses
- …from improved understanding of the unique humanized operating environments
- …integrating deeper and more accurate understandings of society into military decision-making processes
Femtorisks

- Proceedings of the National Academy of Sciences.
  - small-scale (numerically insignificant) dangers that are inherent to system structures and function
  - pose asymmetrically catastrophic risks - can build in consequence, spreading uncontrollably like epidemics in both natural and social systems in such diverse areas as ecology, epidemiology, finance, the Internet, terrorism, and international relations
  - risks are perceived as extremely unlikely or small, but because of interconnections or changes in systems, can lead to major collapses or crises

http://www.iiasa.ac.at/publication/more_IR-12-010.php
Global Systemic Risk

Representation of annual shipping lanes. Image: Manish Nag; data source, nceas.ucsb.edu

About the Project
(2013–16)

There is no better indicator of increasing globalization than the massive and accelerating increase in international transactions beginning in the late 1970s. These in turn have required the construction of a complex system of global nodes and links providing the channels through which these can flow. The interdependence of massive global interactions and structures has caused systemic risk to increase exponentially in recent times. Tangible risks—in systems as diverse as energy exploration and production, electricity transmission, computer networks, healthcare, food and water supplies, transportation networks, commerce, and finance—now threaten global
Data Analytics & Social Media

- Social media has introduced a new and profound layer of complication to how we listen to the voice of the masses.

- The technology has replaced the reductionism of the old world with a bafflingly dense ecosystem of echo and amplification.
Over one million tweets about Egypt from two days, January 28 and February 4, 2011, that the NPS CORE LAB downloaded using a research tool on the Twitter API (Application Programming Interface).
Data Analytics & Social Media

https://globalecco.org/mining-twitter-data-from-the-arab-spring#17
Data Analytics & Social Media

❖ What Data Analytics can reveal in Social Media
  ❖ Names (IP Addresses) of Influencers
  ❖ High Frequency Terms
    ❖ Trending Topics
    ❖ Emerging Sentiments
  ❖ Connections (Links) between Persons/Organizations
  ❖ Group Formation (Evolution)

❖ What Data Analytics cannot reveal in Social Media
  ❖ Black Swans (Femtorisks)
Where Syria's Foreign Fighters Come From
Estimated number of jihadis in Syria from selected countries in 2014*

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Jihadis</th>
<th>Muslim Population</th>
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</thead>
<tbody>
<tr>
<td>Russia</td>
<td>800+</td>
<td>16,379,000</td>
</tr>
<tr>
<td>France</td>
<td>700+</td>
<td>4,704,000</td>
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<tr>
<td>United Kingdom</td>
<td>500</td>
<td>2,869,000</td>
</tr>
<tr>
<td>Germany</td>
<td>300</td>
<td>4,119,000</td>
</tr>
<tr>
<td>Australia</td>
<td>250</td>
<td>399,000</td>
</tr>
<tr>
<td>Belgium</td>
<td>250</td>
<td>638,000</td>
</tr>
<tr>
<td>Netherlands</td>
<td>120</td>
<td>914,000</td>
</tr>
<tr>
<td>United States</td>
<td>100+</td>
<td>2,595,000</td>
</tr>
<tr>
<td>Denmark</td>
<td>100</td>
<td>226,000</td>
</tr>
<tr>
<td>Norway</td>
<td>50</td>
<td>144,000</td>
</tr>
<tr>
<td>Ireland</td>
<td>30</td>
<td>43,000</td>
</tr>
<tr>
<td>Sweden</td>
<td>30</td>
<td>451,000</td>
</tr>
</tbody>
</table>

* Excluding Islamic majority countries
Sources: CNN, National Governments, Pew Research
Where are ISIS supporters tweeting from?
Top locations claimed by Twitter users supporting ISIS in 2015 *

- Saudi Arabia: 866
- Syria: 507
- Iraq: 453
- United States: 404
- Egypt: 326
- Kuwait: 300
- Turkey: 203
- Palestinian Territory: 162
- Lebanon: 141
- United Kingdom: 139
- Tunisia: 125

* sample size 20,000
Source: Brookings Institute
A new frame for CVE: Analyze beliefs, but counter behavior
Countering Violent Extremism

❖ Lack of progress in CVE
  ❖ Focused on the wrong objective
  ❖ Countering ideology
  ❖ Assume that religious belief alone drives behavior.
❖ Instead
  ❖ Focus on countering behavior
  ❖ Investigate the varied motivations behind why people join, support, fund, remain in, or reject terrorist groups and causes
  ❖ Tailor programs towards these different motivations
  ❖ Develop intervention opportunities
  ❖ Influence behavior and disrupt the cycle of political violence

http://www.brookings.edu/blogs/markaz/posts/2015/03/17-lawfare-foreign-policy-essay-norton-cve
Countering Violent Extremism

- What motivates individuals to support ISIS/ISIL and what can be done to counter it?
- ...discussions of CVE...default to a causation fallacy that places religious belief and ideology at the root of terrorism.
- ...focus on identifying ways to influence behavior instead of trying to persuade someone that their beliefs are flawed...
- ...motivations for engaging in terrorism rarely exist as a linear path starting with religious belief and ending in violent behavior.
- ...social, psychological, and ideological factors are best understood as mutually reinforcing categories that intersect in a variety of ways to influence behavior.

http://www.brookings.edu/blogs/markaz/posts/2015/03/17-lawfare-foreign-policy-essay-norton-cve
# Ontology of a Foreign Fighter

## Ideology:

- **a**: a systematic body of concepts especially about human life or culture
- **b**: a manner or the content of thinking characteristic of an individual, group, or culture
- **c**: the integrated assertions, theories and aims that constitute a sociopolitical program

## Motive:

- **a**: the reason for doing something, especially one that is hidden or not obvious.
- **b**: something (as a need or desire) that causes a person to act

## Intent:

- **a**: the state of mind with which an act is done
- **b**: a usually clearly formulated or planned intention

## Capability:

- **a**: the quality or state of being capable; also: ability
- **b**: a feature or faculty capable of development: potentiality
- **c**: the facility or potential for an indicated use or deployment

## Ways and Means:

Methods and resources available to accomplish an end, especially to meet expenses.
Ontology of a Foreign Fighter

participant-in

The Future of Viral Conflict
The Future of Viral Conflict
The Future of Viral Conflict
The Future of Viral Conflict

Fund My Conflict

Popular Now
Political Movements
Insurgencies
Rebellions
Raising a Militia
EVO’s

$87,252.00
The Lions of Rojava need funds for weapons and ammunition

$1,400.00
Bugti tribal militiamen in the Pakistani province of Balochistan need new communications equipment
Conclusions

❖ Complexity and Reductionist Staff Approaches
❖ Femtorisks
❖ Data Analytics for Social Media
❖ Countering Violent Extremism (CVE)
❖ Ontology of a Foreign Fighter
❖ Future of “Viral” Conflicts
BFO and the Global Mobility Enterprise

Bill Mandrick
Agenda

• Opening Vignette

• Joint Capabilities Integration and Development System

• Basic Formal Ontology and Levels of Granularity

• Global Mobility Enterprise

• Non-Destructive Inspection (Data)

• Closing Vignette
Generations of seafarers’ advice/folklore:
- Sent ships directly into calms
- Pitted them against opposing winds and currents
- Tripled route lengths to avoid non-existent hazards (e.g. NY to Rio de Janeiro)

"Pathfinder of the Seas" and "Father of Modern Oceanography and Naval Meteorology"

First U.S. Naval officer to write a book on nautical science: The Physical Geography of the Sea (1855)

Saw patterns in Wind, Tidal, and Current events

Interviewed Captains, sailors, navigators

Studied barometers, compasses, sextants, chronometers, nautical book, old maps, charts, log books...teeming with information

Matthew Fontaine Maury
(January 14, 1806 – February 1, 1873)
Crowdsourcing data in 1842: early version of social network where Sailors recorded very specific observations

Citizen Science—a term applied to data collection methods that engage the public in scientific research

Aggregated the data with “computers”

Created entirely new form of standardized navigational chart

Standardized form for logging ship’s data

Collective information in Navy’s stockpile of old ship logs could improve navigation

Natural sea lanes presented themselves from the data

Maury’s charts cut long voyages by about a third... saving merchants a lot of money

Joint Capabilities Integration and Development System

- To address capability shortfalls, or gaps as defined by combatant commanders
- Provides a capabilities-based approach to requirements generation
- Functional Solutions Analysis
  - Doctrine
  - Organization
  - Training
  - Materiel
  - Leadership
  - Personnel
  - Facilities
- Joint Requirements Oversight Council
  - C4/Cyber
  - Battlespace Awareness
  - Force Application
  - Logistics
  - Protection
  - Force Support
BFO and Levels of Granularity
# Levels of Granularity

<table>
<thead>
<tr>
<th>RELATION TO TIME</th>
<th>CONTINUANT</th>
<th>OCCURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRANULARITY</td>
<td>INDEPENDENT</td>
<td>DEPENDENT</td>
</tr>
<tr>
<td>ORGAN AND ORGANISM</td>
<td>Organism (NCBI Taxonomy)</td>
<td>Anatomical Entity (FMA, CARO)</td>
</tr>
<tr>
<td>CELL AND CELLULAR COMPONENT</td>
<td>Cell (CL)</td>
<td><strong>Cellular Component</strong> (FMA, GO)</td>
</tr>
<tr>
<td>MOLECULE</td>
<td>Molecule (ChEBI, SO, RnaO, PrO)</td>
<td><strong>Molecular Function</strong> (GO)</td>
</tr>
</tbody>
</table>

The Open Biomedical Ontologies (OBO) Foundry
ANNEX 3-17 Air Mobility Operations

Introduction to Air Mobility Operations
- Global Mobility Enterprise
- Types of Air Mobility Operations
- Intertheater and Intratheater Air Mobility Operations
- Sources of Mobility Air Forces
- The Airman’s Perspective on Air Mobility Operations

Command Relationships
- US Transportation Command
- Air Mobility Command
- Geographic Organization and Control
- Air Operations Center
- Director of Mobility Forces
- Integration of Functional and Geographic Mobility Structures
- Command and Control of Other Air Mobility Operations

Air Mobility Planning Strategic Guidance
- Air Mobility Planning General Planning Considerations
- Concept Development
- Plan Development

Air Refueling Effects
- Air Refueling Operations
- Air Refueling: Joint and Multinational Operations

Air Mobility Support and Contingency Response
- Functions of Air Mobility Support
- Command and Control of Global Air Mobility Support System
- Air Base Opening
- Air Mobility Division Augmentation Units

Aeromedical Evacuation (AE)
- Aeromedical Evacuation Effects
- Aeromedical Evacuation Operations
- Command and Control of Aeromedical Evacuation
- Laydown (Operations Phasing and Force Sequencing)
- En Route Care Transport Team
- AE Aircraft Considerations
- AE of Contaminated or Contagious Casualties

Appendix A: Airlift Mission Types
Appendix B: 618 AOC (TACC) Organization
Global Mobility Enterprise

The global mobility enterprise is an integrated series of nodes that support air mobility operations. The four components of the enterprise consist of Airmen, equipment, infrastructure, and command and control (C2). In a dynamic, complex, or contested environment, the enterprise requires global situational awareness through collaboration, coordinated operations, and adherence to processes and support disciplines.

Specifically, the airfields or nodes that are part of this enterprise have the four components (Airmen, equipment, infrastructure, and C2). When contingencies arise, planners identify key nodes and components. Mobility Airmen label these nodes as aerial ports of embarkation (APOEs), aerial ports of debarkation (APODs)/hubs, intermediate staging bases, and the forward operating bases (FOBs).

Source: https://doctrine.af.mil/download.jsp?filename=3-17-D02-Mobility-GME.pdf
Elements of the Global Mobility Enterprise

- Facility
  - AerialPort
  - Airfield
  - Airhead
  - Airport
  - AirTerminal
  - OperatingBase

- Vehicle
  - Aircraft
    - FixedWingAircraft
    - JetAircraft
      - C5Galaxy
      - F14Tomcat
      - F15Eagle
      - F16FightingFalcon
    - PropellerAircraft
      - AC130Hercules
      - C12Hurricane
      - V22Osprey
    - RotaryWingAircraft
      - CH47Chinook
      - HH60Pavehawk
      - OH58Kiowa
      - UH60Blackhawk
      - UnmannedAerialVehicle

- Process
  - AircraftMaintenanceProgram
  - AircraftAssessment
    - AircraftDurabilityAssessment
    - AircraftDamageToleranceAssessment
  - Method
    - NonDestructiveInspectionMethod
      - LaserShearographyInspectionMethod
      - RadiographicInspectionMethod
      - UltrasonicInspectionMethod
      - EddyCurrentInspectionMethod
      - LiquidPenetrantInspectionMethod
      - MagneticParticleInspectionMethod
  - MilitaryOperation
    - AirOperation
      - AirdropOperation
    - AirMobilityOperation
      - AirliftOperation
      - AirMobilitySupportOperation
      - AirRefuelingOperation
    - LandOperation
    - SeaOperation
    - SpaceOperation
    - UnderseaOperation
Elements of the Global Mobility Enterprise

- Air Lift Organization
  - has-member: Airman
  - has-location: Operating Base
  - bearer-of: Airlift Capability

- Operating Base
  - has-part: Airfield
  - has-participant: Aircraft

- Airlift Capability
  - realized-by: Airfield

- Airlift Operation
  - has-participant: Aircraft
Nondestructive Inspection Methods, Basic Theory

Method
- NonDestructiveInspectionMethod
- LaserShearographyInspectionMethod
- RadiographicInspectionMethod
- UltrasonicInspectionMethod
- EddyCurrentInspectionMethod
- LiquidPenetrantInspectionMethod
- MagneticParticleInspectionMethod

SurfaceBreakingDiscontinuity
- Pit
- Crack
- Hole
Liquid Penetrant Inspection is a method used to detect surface-breaking discontinuities (e.g., cracks, pits, etc.) in nonporous materials.
### Sample of Things Measured by NDI

<table>
<thead>
<tr>
<th>Brightness</th>
<th>Viscosity</th>
<th>Coating Thickness</th>
<th>Metal Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistivity</td>
<td>Radiation</td>
<td>Ultraviolet Light</td>
<td>Intensity of Visible Light</td>
</tr>
<tr>
<td>Field Strength</td>
<td>Residual Leakage</td>
<td>Tensile Strength</td>
<td>Hardness</td>
</tr>
<tr>
<td>Current Magnitude</td>
<td>Signal Amplitude</td>
<td>Alternating Current Resistance</td>
<td>Conductivity</td>
</tr>
<tr>
<td>Sound Level</td>
<td>Pixel Density</td>
<td>Surface Anomalies</td>
<td>X-Ray Absorption</td>
</tr>
</tbody>
</table>
Pattern Analysis Plot Sheet

- Lots of Data
- Uncovering Patterns
- Correlations
- Influences C2

Closing Vignette
Questions?

http://www.wikiwand.com/en/United_States_Air_Force