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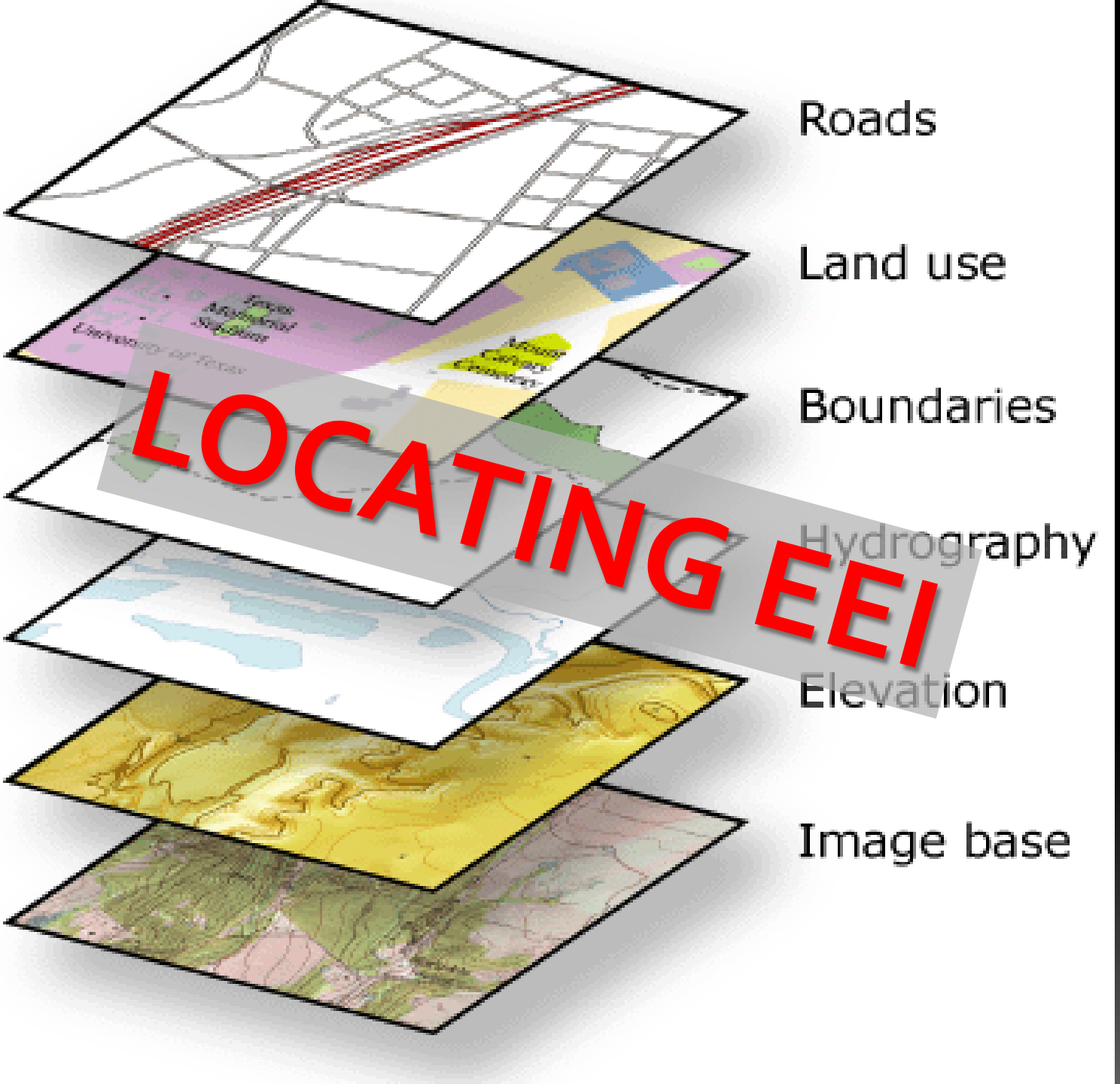
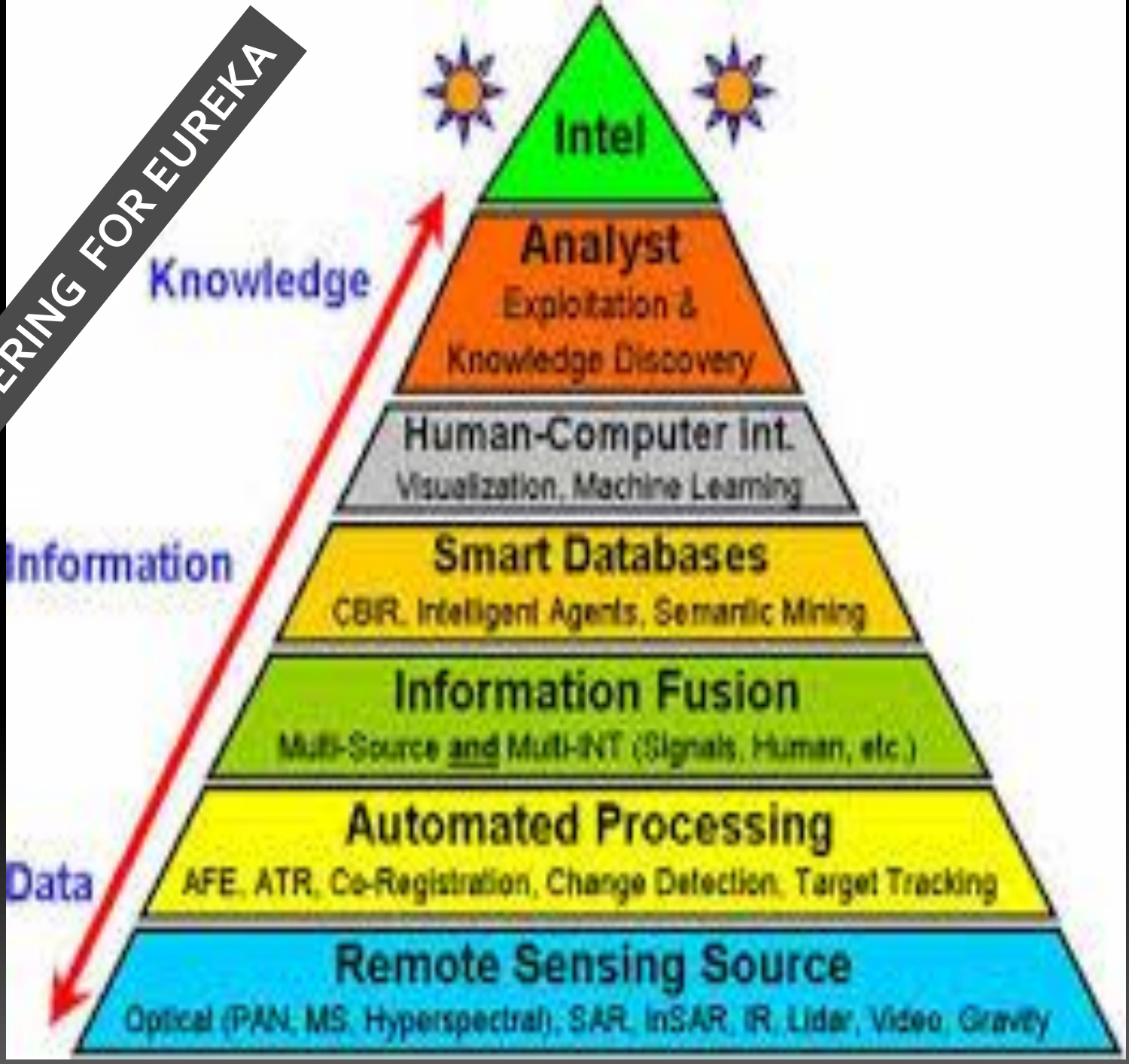
CUTTING-EDGE ENGINEERING FOR MODERN GEOSPATIAL SYSTEMS

1. Impact of Engineering on Geospatial Systems.
2. War fighter Requirements and Expectations.
3. Challenges of Engineering.

How Engineering Will Impact Geo Spatial Systems?


MICHIGAMME
River


Roads
Land use
Boundaries
Hydrography
Elevation
Image base
LOCATING EEI


ENGINEEERING FOR EUREKA
Knowledge
Information
Data
Intel
Analyst
Exploitation &
Knowledge Discovery
Human-Computer Int.
Visualization, Machine Learning
Smart Databases
CBIR, Intelligent Agents, Semantic Mining
Information Fusion
Multi-Source and Multi-INT (Signals, Human, etc.)
Automated Processing
AFE, ATR, Co-Registration, Change Detection, Target Tracking
Remote Sensing Source
Optical (PAN, MS, Hyperspectral), SAR, InSAR, IR, Lidar, Video, Gravity

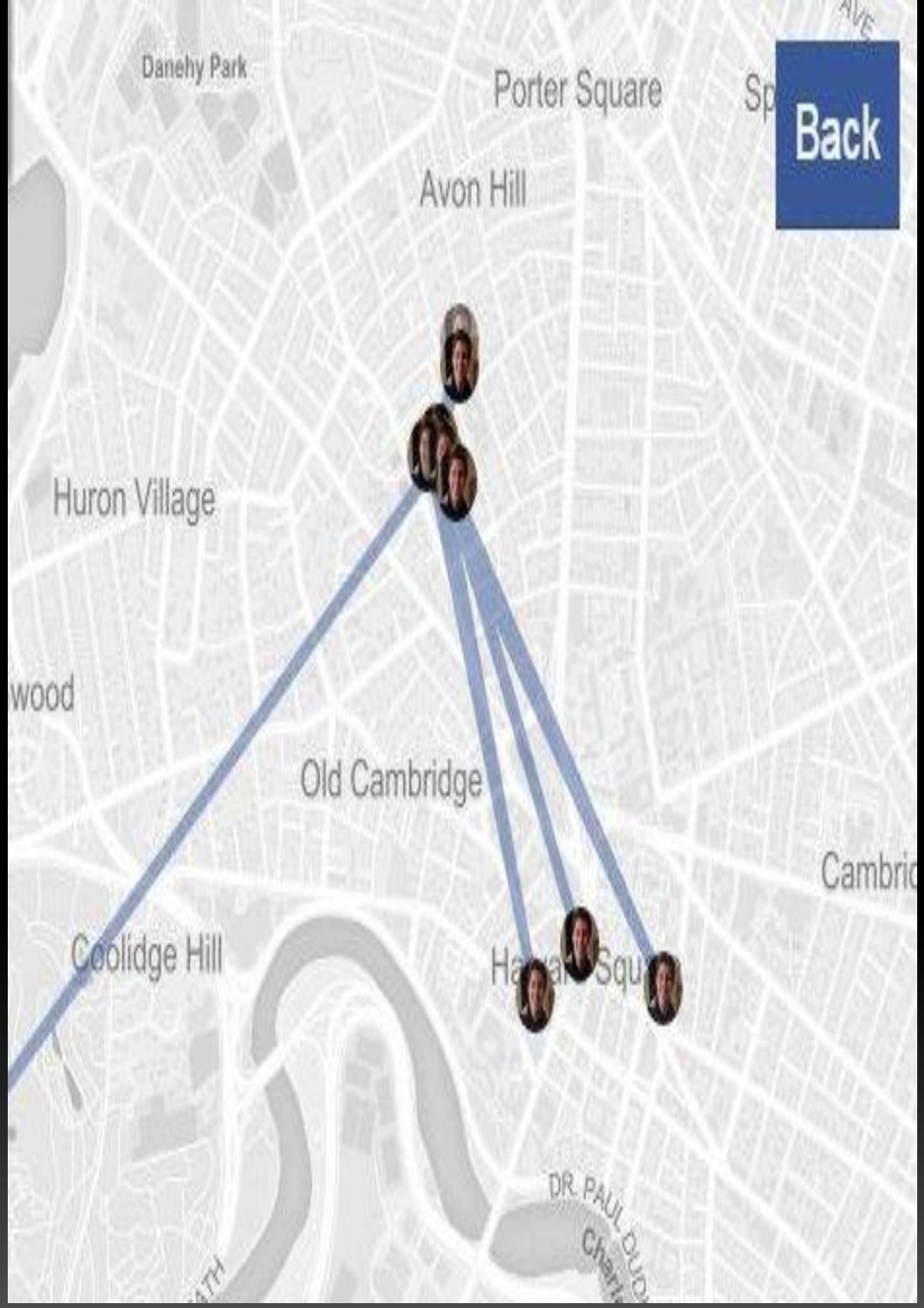
Characteristics of Geo Spatial Systems

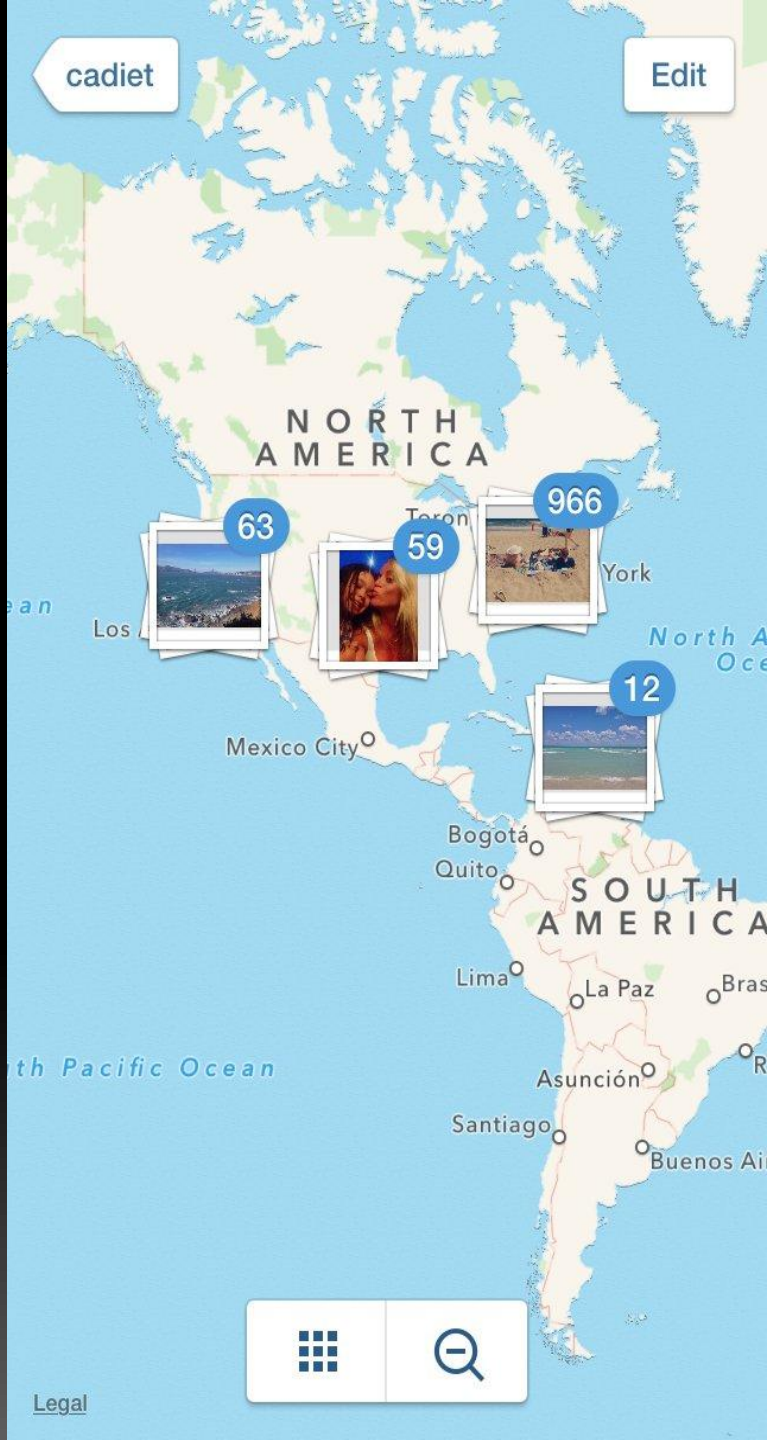
- Fully digitized – effective manipulation of data/meta data in variety of formats and multiplicity of users providing scope for crowd sourcing.
- System of systems – Tweak the part to exploit the whole.
- High level of engineering skills required transcending number of disciplines.
- Advantage of Predictive Analytics.

War fighter Requirements and Expectations.

Social Media to Military

- Geo Engineering tool geo-tagging .
- Face Book Messenger.
- Instagram.
- Google Chrome Extension – Marauders Map.
- Face Book and Hair Dye.
- Shadowy terrorist group Lashkar Islam forced shut mobile communication networks .





Marauders Map Extension

Engineering Application

- Military Geoint engineering challenge is to acquire – convert – deliver in a disruptive environment with robust systems .
- Niche applications single users on the battlefield.
- Stream data to a platoon or a troop commander while providing germane information to the neighbouring entity.

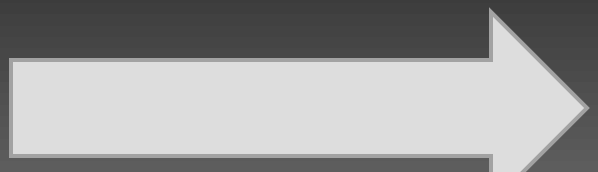
Engineering Geo Spatial Systems

Input

- **Sensors – Space, Aerial, UAVs, Surface etc**
- **Optical camera, radars , IR, multispectral and hyper spectral sensors, SAR, acoustic and full motion video .**
- **Temporal, spatial, radiometric3 and spectral resolutions**
- **Underground targets, foliage penetration, detection of moving objects, biological and chemical is another prospective innovation.**

Output

- Maps.
- Overlays.
- Audio/Video Streaming.
- Navigation inputs to weapons
- Cognitive Support.



Military Requirements

- Prediction.
- Accuracy.
- Fidelity
- Real Time
- Security.
- Redundancy.
- Contextual.
- Fusion.
- Simplicity.

Importance of Cutting Edge Engineering

- Match unique needs and characteristics of provider of information and user.
- ”Smart map,” used to denote different characteristic to different entities.
- Allowing use of same map by different users with each ones specific requirements –
  - Artillery fire controller to plot, predict and correct gun fire
  - Tank commander to locate an enemy counter fire ambush without cross information clutter.

Engineering “Internet of the Battlefield”

- Tanks programmed geospatially will communicate with tanks, artillery with artillery guns and infantry soldiers with their counter parts while excluding others through spatio-temporal correlation in terms of space and time.
- Silo connectivity provided through geospatial location.
- Factor in cross silo connectivity through engineering.

Future - Redundancy through Engineering

- Real time geo-positional data fed to fighter pilot through heads-up digitization - forward air controllers will be passé.
- Future of Artillery fire controller??
- "Smart," munitions should be able to locate the target as well as the position of own troops thereby avoiding fratricide.
- Every soldier can possess a, "Sudarshan Chakra," chase a target through minute spatio-temporal mapping and destroy it through camouflage and cover.

Challenges of Engineering Geospatial Systems

Engineering Challenges

- Data intensive layers of metadata with complex domain ontologies need to be synchronized with semantic mapping.
- Work through multiplicity of platforms and operating systems from the hardened battle field, "smart phones," to systems using open source software or propriety as Windows 8.
- Indian environment where every service is using different software both operating and application and varied media – engineering challenge will be greater.

Cloud, Big Data and Crowd Sourcing

- Cloud and Big Data to gain full advantage from geospatial technologies is a sine qua Nan.
- Weaving in security and differentiation in cloud base streaming or through Big Data analytics needs a creative approach in engineering challenges yet to be identified

Assisting Cognition

- Real time crowd sourcing in an operational environment feeding the same to, “need not know,” will pose a challenge
- De-saturate cognition of commanders and staff.
- Engineering human cognitive with the geospatial has been achieved in Iraq and Afghanistan will need special tools.

Over Expectations of User

- Users having knowledge of LiDAR (Light Detection and Ranging) would expect inputs for using exact weight and lethality of munitions to reduce a dugout in the mountains to rubble.
- Can LiDAR technology topographic and bathymetric or infra red and water penetrating laser be engineered to deliver these to the war fighter of the future?

Engineering Disruptive Change

- Google outdid Hotmail, Gmail outdone by Face Book and we are yet to see the contours of competitor of Face Book
- Global Positioning System (GPS), Web mapping, light detection and ranging (LiDAR) mapping.
- Next generation transformations are likely to be disruptive rather than linear.
- Engineering disruption rather than change will remain the ultimate challenge in Geospatial Systems

Cutting Edge Technologies to Meet the Challenges

EXPLOITING POTENTIAL OF EACH FACET IN THE SYSTEM HARDWARE AND SOFTWARE THROUGH ENGINEERING