

[Robust] Best Practices

IDEATION

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Requisite Leadership

Skills/Propensities

- Creativity
- Continuous Learning
- Motivational Psychology [individual/team]
- Communication skills including LISTENING
- Strategic Outlook [Chess not Checkers]
- [Realistic] Economics
- Personal Confidence/Optimism
- Flexibility AND Perseverance [“Know when to hold em, and when to fold em”]

Elements of the Creative Process

- Excellent Problem Definition/metrics
- Knowledge Collection/study
- Assembly of multiple/many solution possibilities/approaches [both from literature and ab initio]
- Triage/study/evaluation of possibilities, all metrics,
- If are really creative, should FAIL some 70% of the time....

Elements Conducive to Creativity

- Masses of Information taken in/digested [regarding BOTH Problem and Solution[s]]
- Well Defined Goals,an Important Challenge
- Tolerance for failure/management of risk via multiple solution paths]
- Perseverance
- Independence/open environment/"Flexibility"
- Multiple prospective Solutions [borrow, steal, adapt,combine, create, invent, collect]
- Absolute honesty, toleration of "rebellion"/Argument/Questioning, no NIH
- Encouragement/rewards
- Adequate resources

Characteristics of Creative Organizations & Individuals

- Excited
- Independent
- Spontaneity
- Experimental
- Subversive
- Rebellious
- Impertinent
- Courageous
- Wide Interests and Knowledgeability
- Self-Reliant
- Iconoclastic
- Argumentative
- Challenging
- Questioning
- Perseverance
- Playfulness
- Preference for complexity
- Tolerance of Ambiguity
- Confidence
- Curiosity
- Non-Conformity

Some useful creativity “tricks”

- Collect/obviate ASSUMPTIONS
- Revisit old solution approaches with new technologies
- Question EVERYTHING
- Read/search/study the WORLD-WIDE Literature
- Search/study more and more broadly
- Generate analogies
- Go to the” boundaries”

Ideation

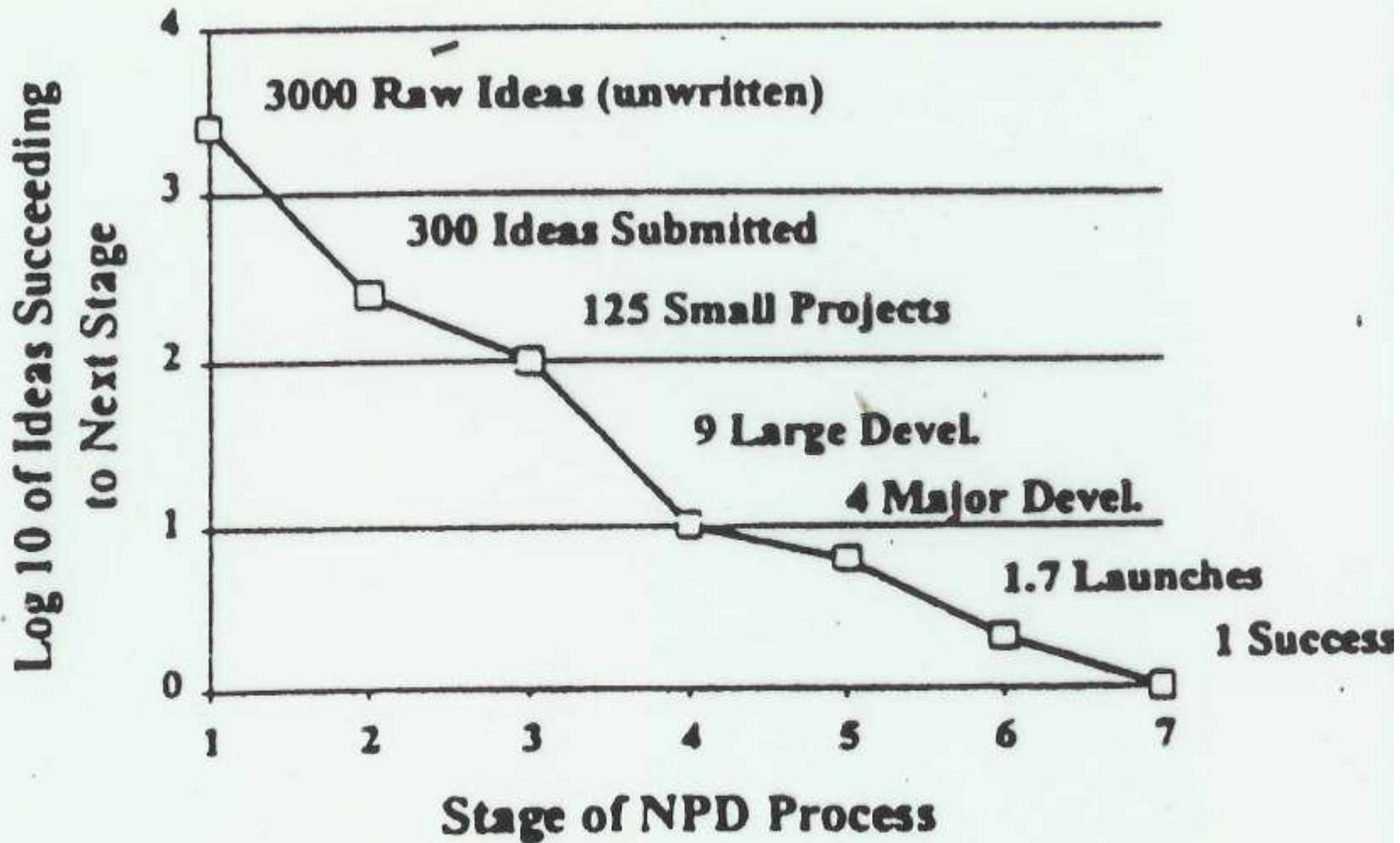
Defined as **Creation** and
Evaluation of IDEAS

Motivation

- **Strong push/ pull to Ideate**, e.g. being shot at dawn, living on soft money, being paid to do this, personal drive to solve important problems
- In the case of the Navy – Saving money, Staying “afloat”, Career aggrandizement, Prevailing in National Security, having a “neat” problem to work.....ETC.

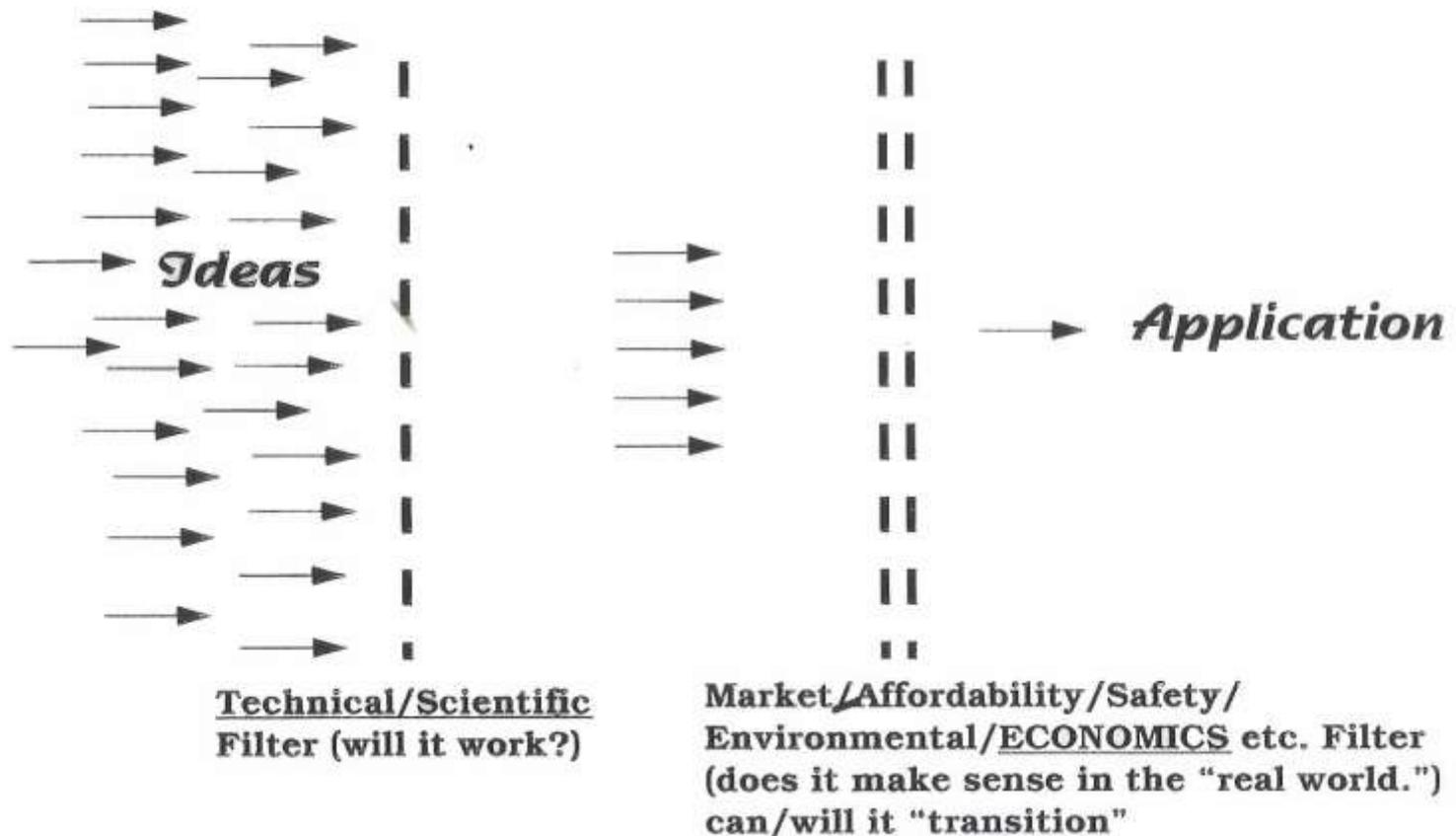
Risk Embracing

- To “Manage” risk, ideate and study/ triage multiple solutions
- Stats indicate that the multiple solution approach [taken in the Manhattan Project, as an example] provides excellent assurance of a viable approach
- Robust Industrial Experience, some 3000 new ideas and some 8 years evaluation/ triage for 1 idea viable in the real world product
- Impossible to, initially, “Pick Winners”, simply too many real world parameters



***“Universal” Industrial Success Curve
for Substantially New Products***

THE (SERIAL) "FILTERS" THROUGH WHICH AN IDEA/APPROACH/CONCEPT MUST PASS BEFORE UTILIZATION



THE “CRUCIBEL” THROUGH WHICH NEW/DIFFERENT (CIVILIAN) DESIGNS HAVE TO PASS

(generic “technology filter” - the “illities”)

ENGINEERING

- Producability/manufacturability
- Maintainability/supportability
- Reliability
- Flyability/airworthiness
- Inspectability
- Performance (aero, structural, propulsive)
- Flexibility (growth, Pax/cargo, variable production rate)
- Repairability
- Operability
- Durability/damage tolerance
- Airport compatibility

THE “CRUCIBEL” THROUGH WHICH NEW/DIFFERENT (CIVILIAN) DESIGNS HAVE TO PASS

ECONOMIC/BUSINESS

- Profit (airframes/airlines)
- Fuel usage/ “carbon tax”
- Size/weight/part count/material/complexity
- Ancillary/ “side” effects
- Product liability
- Timeliness
- Protectability/ease of duplication/exclusive rights
- Criticality of requirement/novelty
- Regulatory issues
- Risk
- Distribution system
- Availability/productivity
- THE COMPETITION (product, approach)

THE “CRUCIBEL” THROUGH WHICH NEW/DIFFERENT (CIVILIAN) DESIGNS HAVE TO PASS

SAFETY/ENVIRONMENTAL

- “Crashworthiness”
- Vortex hazard
- Weather (icing, microburst)
- Stall/spin
- Fatigue
- Emissions
- Engine and airframe noise

Attitude of Humility

- Willing to learn from anyone, anywhere, any time
- No NIH
- No arrogance

Ideation Approaches

- Delphi [ask others, especially informed/ productive others]
- Group activities [Conventional “Brainstorming”] INFORMED BY PREGAME FOCUSED STUDY/ HOMEWORK
- “Theft” [Identifying/studying existing approaches from anywhere and any time including historical]
- Personal “Eurekas”[enabled by personal knowledgeability effort[s]]
- Open Innovation [Advertise for solution spaces up to worldwide]
- Machine Intelligence, e.g. the “Imagination Engine”

[Example] - Automated Invention

- Steve Thalers' Creativity Machine AKA Imagination Engine
- A trained neural net is deprived of all rational input
- “Dreams”, apparently as people dream, producing multitudinous new combinations/”ideas”
- A “critic” neural net evaluates these ideas for various problems/metrics
- Quite successful, good “Track Record”, many other such.....NOW

Machine Intelligence

- **Approaches:**
 - **Experiential - Behavior Based/“learning” (neural nets/other “Soft Computing” - genetic algorithms, fuzzy logic,etc..)**
 - **Nano-section/replicate brain in Silicon**
 - **“Emergence”**
- **Should produce Artificial/Cyber “life” which will possibly-to-probably be sentient but will not be anthropomorphic**

IBM Blue Brain Project

- 10 year project started 5 years ago to nano-section the neo-cortex and replicate it in Silicon.
- Now , 5 years into it, director projects a human level machine intelligence in ~ 10 years, Many project such for 20 plus years out.
- In the Runup, Machine Intelligence is becoming VERY GOOD, e.g. enables Avatars for on-line instruction in lieu of “Teachers”

“INTELLIGENT (SOFTWARE) AGENTS”

•Functions:

- Sense (search)/find/integrate and analyze/convert data into information and (perhaps) even knowledge based upon a high level instruction set

•Characteristics:

- Long-lived, semi-autonomous, proactive, adaptive, domain-oriented reasoning

Moving from “Search Engines” towards AI

Methods to Rapidly Evaluate Ideas

- Commercial CAE on desk [~ 15% precision] to work initial Tech triage
- On desk User-Friendly Systems level software to evaluate ideas at systems level
- “Value-Web” of Highly Knowledgeable contacts throughout the world to provide a “Read”, initial reaction/ response

Precepts

- Major effort[s] expended to define/ understand the problem well, in all aspects
- Emphasize ideas with large “Margins”, always lose as become more “Real”
- Spirit of RELENTLESS GROWTH, DRIVEN/ Passionate Participants, [nearly] unattainable Goals, “constructive paranoia”
- Few “Inhibitions” other than laws of Physics etc. and reasonable Economics, “Divergent/DEVIANT Thinking”
- Question EVERYTHING, including status Quo and ASSUMPTIONS, go for SURPRISE
- Invite the “Trouble Makers”, the Mavericks, are SUPPOSED to become UNCOMFORTABLE, feel “Threatened”

Knowledgeability Approaches

- Perusal of at least 10 free daily tech advancement reporting/ abstracting services [there are at least 30-40 available]
- Intelligent Agents to continually search and EVALUATE Tech Arenas, informed by personal proclivities, 24/7/365
- Requirement to conduct/ document literature review before beginning a project
- Incite Curiosity as a way of life.....Workforce Re-Education
- Establish/ continually feed a Navy-to-unit unique “Knowledge Base” [Trip Reports, all program charts, ideas that occur, things learned/ heard, Center “Yellow Pages”,ETC.....
- Measure/ REWARD Knowledgeability
- Utilize commercial tech update/ evaluation services, AKA Commercial Intel Services

**“IF YOU THINK BEING INFORMED IS
EXPENSIVE, YOU OUGHT TO LOOK AT THE
COST OF IGNORANCE”**

Derek Bok

President, Harvard University

The lifeblood of the creative organization is masses of uncategorized, unanalyzed, undigested, messy information. It is the raw material of creativity.

Robert L. Kuhn

“Creativity and Strategy in Mid-Sized Firms,” Prentice-Hall, 1989

The Three Phases of Reaction to an Idea.....

- **Ridicule** [Usual response to something very NEW]
- **Resistance** [The Paradigm shift is threatening existing rice bowls]
- **Recognition** [Appears to be OBVIOUS]

“The main function of in-house scientists employed by companies is not to do in-house research, but to read, interpret and capture the global literature”

Terence Kealey

“New Scientist,” 1996

“We understand that the only competitive advantage the company of the future will have is its managers’ ability to learn faster than their competitors”

Arie deGeus, Royal Dutch/Shell

“Our behavior is driven by a fundamental core belief: the desire and ability of an organization to continually learn from any source—and to rapidly convert this learning into action—is its ultimate competitive advantage”

Jack Welch, General Electric

**Organizations that win/create the
future**

**Are rebels and Subversives, they
break
rules/cheat**

**The future is NOT an
Extrapolation of the past**

Competing for the Future 1994

**“Scientists at work have the look of creatures
Following genetic instructions; they seem to be under the
Influence of a deeply placed human instinct...
rather like young animals engaged in savage play**

**There is nothing to touch the spectacle.
In the midst of what seems collective derangement of
Minds in total disorder, with bits of information
being scattered about, torn to shreds, disintegrated,
deconstituted, engulfed-- there suddenly emerges, with the
Purity of a slow phrase of music, a new piece of truth....**

**What it needs is for the air to be made right;
the system must be designed primarily for the elicitation
And the celebration of surprise..”**

Written by a former head of NIH and Sloan-Kittering

“Over the Long Run, Superior Performance Depends On Superior Learning - The Key to Survival is the ability to run experiments “In the Margin”, to continually explore new business and organizational opportunities that create potential new sources of growth - [The Leader] needs the ability to BUILD SHARED VISION AND CHALLENGE PREVAILING MENTAL MODELS”

Peter Senge, MIT Sloan [1990]

Be “Prepared”

“Creative individuals have been accused of being maladjusted, anti-social and anti-religious.” Creative children have earned the animosity of some teachers. Creative people have been vilified or even killed--

Creativity is practiced at some risk

An Assertion:

“Creativity” is not some mysterious gene one must be born with, creativity is rather, from extensive personal experience, eminently “teachable” and is mainly a function of providing/receiving support in terms of (a) understanding the steps in the process; (b) knowledge resources for problem definition and solution; (c) emotional/psychological encouragement to surmount “negative results” (should “fail” at least 80 percent of the time); and (d) rewards

“Go out on a limb, that’s where
the fruit is”

Frequency of characteristics of a successful Inventor Given by 710 inventors

Perseverance	503
Imagination	207
Knowledge and Memory	183
Business Ability	163
Originality	151
Common Sense	134
Analytic Ability	113
Self-Confidence	96
Keen Observation	61
Mechanical Ability	41

My Impression of Innovation in the Navy – You train your people to follow orders and SOP, you have to, e.g to avoid “Running Aground” and so they will put themselves in Harms way. The most innovative Navy folks I have interacted with appear to have successfully protected their innate creativity, walling it off from their training..... They appear to successfully operate in two worlds – the standard “conformity rewarding” Navy World and a world where they are “free” to think “differently .I have known several Flag Officers with these characteristics, and I could tell which side of their personality I was speaking with.

Going forward, the Navy appears to want to avoid this “adaptation” requirement and instill a greater sense of Innovation into the “real, day-to-day Navy”. For good reasons this will be difficult, but well worth working towards.

BTW – It is not just the Navy that historically tends to kill creativity. Studies indicate that almost all children pre Kindergarten are very creative, by 2nd grade few are, the regimentation of the present education process kills creativity. The ones that still “have it” tend to be children with a great deal of independence and competition in their lives

Emerging Navy Sitreps that require
Creative Solution Spaces

Surprise!

- **Technical Surprise** – New Technologies enabling major and unanticipated impacts/ advantages in one or more of the metrics/ functions of warfare – Lethality, Range, Logistics, C4ISR, Affordability, ETC....
- **Operational Surprise** – Creative Utilization of combinations of old and new technologies against unanticipated vulnerabilities, often in a systems context.....

Required Going Forward for National Security

- Intuiting “Operational Surprise”, we are hardly ever technically surprised, are often operationally surprised.
- Required for successfully addressing Operational Surprise
 - Wide and Deep Tech Knowledgeability
 - Wide and Deep U.S. Vulnerabilities Knowledgeability
 - Superb Creativity to Intuit how “they” would Surprise the U.S.

Sample Technological Forecasting Approaches

- Delphi - Consult Experts,iterate with them,take a vote.....
- Trend Lines - Extrapolation,works somewhat nearer term for individual Techs,poor for non-linear,farther term and Tech Synergisms/interactions
- Scenarios - Usually too pathological/extreme. Useful to “get them out there”,can include “interactions”
- [Very] Widely Educated Creative and Experienced Minds

The Real Essence of Technological Forecasting, given wondrous Technology Intelligence/Education [aka “inputs”] is “Sensemaking”, Sorting through exceedingly Diverse and “Noisy” “Information/Data across a broad spectrum of “Dimensions” [Competitive, Societal, Economic, Alternative[s], ETC....] to infer most likely then year outcome[s] in an inherently extremely Non-Linear & Uncertain Solution Space

Common Technological Forecasting Shortfalls

- **Focusing on single technology impacts [they are all changing rapidly simultaneously]**
- **Being too near term/Evolutionary**
- **Consulting too few “sources”**
- **Disbelief that things could change that fast that much - We always err on the conservative side for the longer term,AKA “Failures of Imagination”**

Operational Surprise – Bottom Lines

- 70% PLUS of research is offshore
- World is Flat Technologically
- There is an IDA Person [Andy Hull] who attends/collects from worlds Arms shows, has a brief that is EXTREMELY WORRISOME, NOW! Sitrep Will only get worse.....
- U.S. IS NOT WORKING OPERATIONAL SURPRISE
- We WILL get Surprised, there are surprises that could/would TAKE US DOWN

THE KEY TECHNOLOGIES

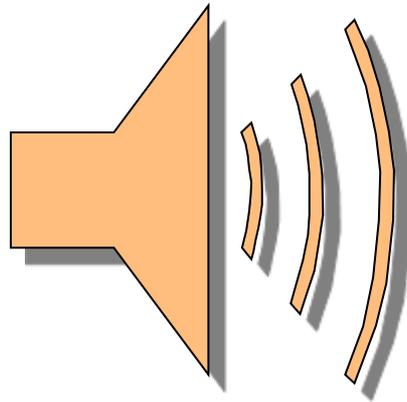
(highly synergistic / at the frontiers of the small / in a “feeding frenzy” off each other)

- **IT** (comms/computing/sensors/electronics/machine intelligence)
- **Bio** (genomics/molecular biology/designer life forms)
- **Nano** (coatings/barriers/computers/sensors/materials/“assemblers”)
- **Energetics** (HEDM (various)/revol. solar/biomass/explosives/propellants/storage)
- **Quantum** [crypto/computing/sensors/optics/Electronics]
- **Societal Technological Systems** (motivational asynchronous “distance learning,” immersive/virtual presence, “tele-everything,” “robotic everything,”]

Worldwide IT Revolution

- **Comms/Computing/Sensors/Electronics**
- **Factor of E08 since '59 [Moore's Law]**
- **Factor of E08 to E12 further improvement [Silicon, Molecular/CNT, Quantum, Bio, Optical]**
- **Quantum computing is potentially E44 better for some-to-many applications**
- **Beyond Human Machine Intelligence?**
- **Automatics/Robotics "in the large"**
- **Immersive multi-sensory VR/"Holodecks"**
- **Ubiquitous multi physics/hyperspectral sensors [land/sea/air/space]**

Electron Threats.....



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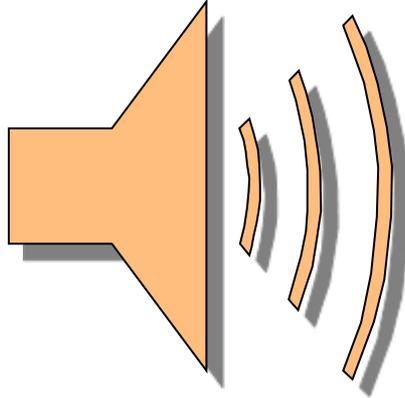
IMPACTS OF ONGOING IT REVOLUTION UPON SOCIETY

- **Work (at home telecommuting, reduced local/corporal travel)**
- **Shopping (at home web based, (robotic?) delivery)**
- **Entertainment/leisure (at home immersive 3-D interactive/multi-sensory via VR/holographic projection)**
- **Travel (3-D/interactive/multi-sensory tele-travel)**
- **Education (at home low cost asynchronous, web based on-demand, highly motivational, life-long distance learning, .edu)**
- **Health (at home interactive tele-medicine)**
- **Politics (increased real-time virtual involvement of the body politic)**
- **Commerce (tele-commerce already ubiquitous)**
- **Tele-Socialization, Tele -[onsite] Manufacturing**

“Rise of the Machines”

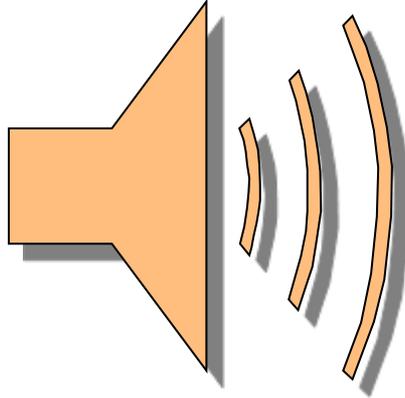
- Machine Intelligence approaching Human via Biomimetics and perhaps emergence
- Autonomous Robotics
- Creating increasing unemployment [manufacturing , now service, soon Intellectual]
- Humans becoming Cyborgs [Retinas, hearts, limbs, brain chips,]
- Emergence of a Global Sensor Grid and a “Global Mind” [Web 3.0++]

“Eggs”



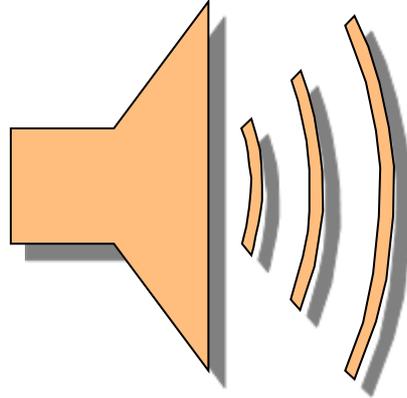
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Inexpensive, Capable UUV's



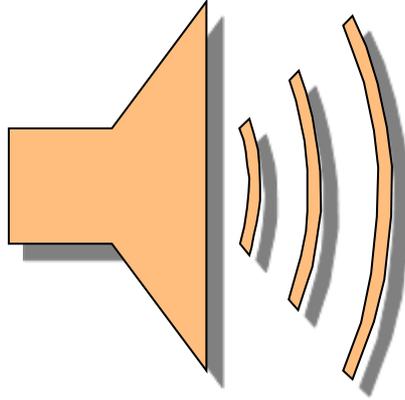
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Emerging Kill Mechanisms Synopsis



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Global Precision Strike



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The Evolving/Changing Nature of Warfare

Overall.....

- We are in simultaneous It, Bio, Nano, Energetics, Quantum Tech Revolution[s]
- Some 70%+ of the research is now OCONUS, 70%+ is Commercial
- The existence of ever less expensive and ever more capable systems is enabling “Warfare from Walmart”, literally.....AND “Armies of one”, literally
- Revolutionary Energetics, ubiquitous brilliant robotics and all signature sensing, as well as wholly new weaponry, vulnerabilities and approaches to “waging War” requires extraordinary vigilance wrt what “they” are up to.

“In a Revolutionary Era of Surprise and Innovation, you need to learn to think and act like a revolutionary [People at Revolutions who don’t act that way have a particular name: Victims]”

Joshua Cooper Ramo “The Age of the Unthinkable”, 2009

Some Aspects of the Evolving Context of National Security Leadership For/In the Future

- Technological Developments, “World is Flat”
- Societal Changes, “Tele-Everything”
- Economic Trends, “Great Correction” [Taxes, Inflation, Interest rates UP, SOL DOWN]
- Ecosystem/Climate Changes/ Strictures [SOL DOWN]
- Competitive Intelligence, “Red Teaming”
- Evolving U.S. Vulnerabilities, e.g. Electrons

Warfare is increasingly a” Tech Game” and due to the nature of the evolving techs increasingly a “Home Game” [Conus hideously Vulnerable]