Geriatric Agenda: Long Term NeuroIntelligence(NI): physiology & physics elucidate, exploit consciousness & sub-c. (sublimated awareness) **to early perception** (reasoning, memory) **self learning** (supervised, **unsupervised**, decision, action). Imaging the days we evolve beyond DNA, Books, to Web, becoming ***Google Intelligence (GI) armed 7-24-on with unsupervised, non-programming learning*.**

Mid Term: Substantiate the ***missing half of Einstein's brain*** as ***glia cells functionality*** maintaining house keep "μ_j". (1) Why constant temperature brains? "(2) Why do we have pairs of sensors? What is the function and behavior of glia at individual synapses? Should the interactions among glia cells and neurons follow the Szu's spontaneity intelligence :min. $H = E_0 + \sum \mu_i \{[W_{ij}] X_j(t) - s_i(t)\} - T_o S$ where T_o=37^{0}C; S= entropy; E=I/O energy? We derived well known

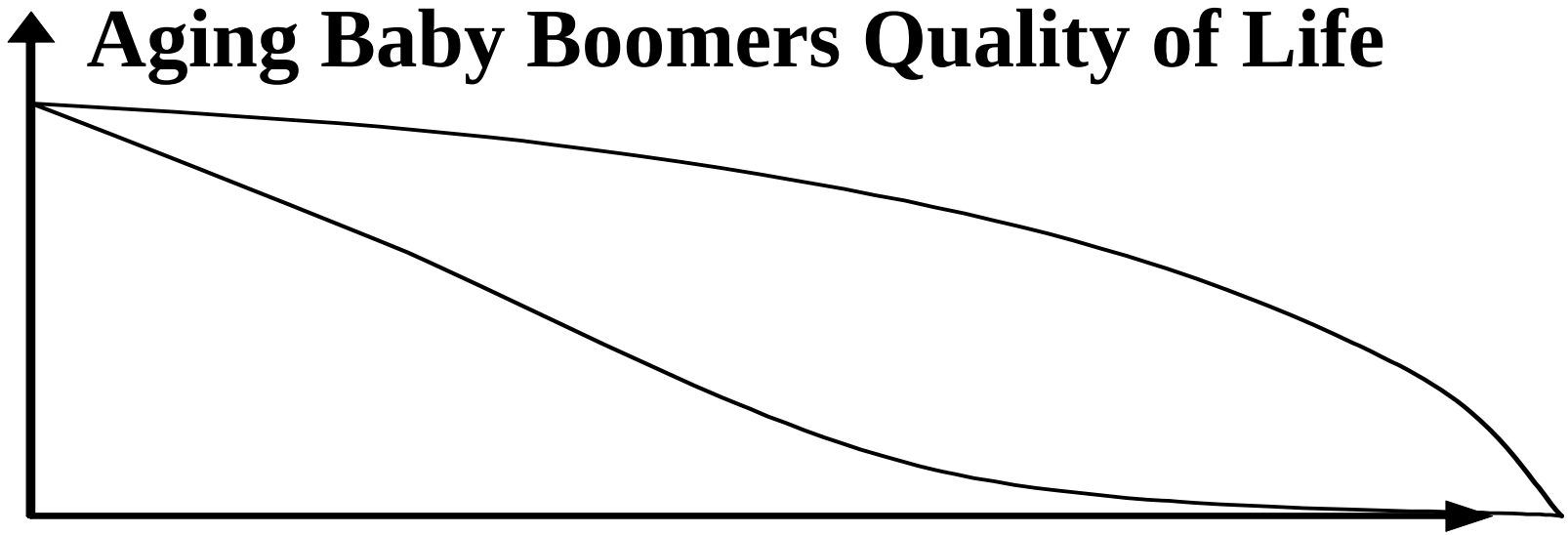
(i) Szu Theorem 1 Hebb Rule: $$\frac{\partial W_{ij}}{\partial t} = -\frac{\partial H}{\partial W_{ij}} \Rightarrow \Delta W_{ij} \approx \mu_i X_j$$

(ii) Szu Theorem 2 Sigmoid Rule: $$\frac{\partial H}{\partial s_i} = 0 \Rightarrow \sigma(\mu_i) = s_i$$

Near Term: To build **Biomedical Wellness (BMW)** engineering test-bed of **biomimetic pairs of biosensors** and to demonstrate Nyquist wellness sampling rate at Home front Motto:"a stitch in time saves nine" using the time-reversal ROC, Next Gen Wavelet for statistics-preserved down sampling, serving aging population measuring "Wellness Baseline Profiling (WBP)" by improving the quality of life of ¼ US Population (78M aging baby boomers) costing ¼ GDP with "preventive, personal, pre-emptive, participatory(4P)" for longitudinal data basis for catching the diseases and dementia.

High-Impact: **Interdisciplinary Computing Intelligence (ICI)** serve the wellness of aging population measuring daily the "Wellness Baseline Profiling (WBP)" to save healthcare cost by improving the quality of life of ¼ US Population (78M aging baby boomers) costing ¼ GDP with the earliest possible diseases and dementia.

Quality of life (WBP giving better IDA because a stitch in time saves nine)



Retirement at 65 years old; average man lived to 78 years and woman at 80

NSF Initiative: *Brain Science Multidiscipline about $20M*

- March 4-6, 2007, Westin Arlington Gateway Hotel, sponsored by NSF Dir. Arden Bement, Deputy Dir. Kathie Olsen, Chief Scientist, Rae Silver, several different divisions of NSF organized Chris Wood, Santa Fe Institute divided into 7 groups of 49 scientists.
- Eve Marder (marder@brandeis.edu)) "Nruroethological & Developmental Molecular & Cellular Approaches" need real time in vivo stochastic variability from axon growth path finding from ion channel, receptor, to neurons;
- Partha Mitra (mitra@cshl.edu) "Organization of Behavior Emerging Principle" needs meso-scale net bridging gaps for example the circadian rhythms from molecular genetic, neural, organ, to behavior;
- Jay McCelland (jlm@psych.stanford.edu) "Learning, Plasticity and Development" need timing synchronization coherent engagement, congruity I/O with primitive & connectivity;
- Emery Brown (brown@neurostat.mgh.harvard.edu)" Signal Proc & its development in brain," need neurosci data in different space & time & new chemical modality;
- Jonathan Sweedler(sweedler@scs.uiuc.edu) "Measuring Brian: From synapse to thought," needs biochemical reverse engineering for elucidate the brain functionality imaging;
- Nancy Kanwisher(ngk@mit.edu) "Cognitive Systems across levels of analysis in brain system," requires better modeling and measurement;
- Ted Berger(berger@bmsrs.usc.edu) "biomimetics and the neuron/silicon interface," needs real time bi-direction encode, represent & transform brain science.
- Few would deny major problems facing humanity are social & economic in nature; but few would consider them as the science of 21st Century. Elucidation of human brains might help de-program current radical indoctrination.
- Tools: Internets, Intelligent (Super)computing, Real-time in-vivo Chembio imaging, Nano-technology, Genetic, Epigenetic, System on Chip, Gene chip, Micro-array,

NSF Initiative: *Brain Science* *Multidiscipline Multi-Millions, Multi-Years*

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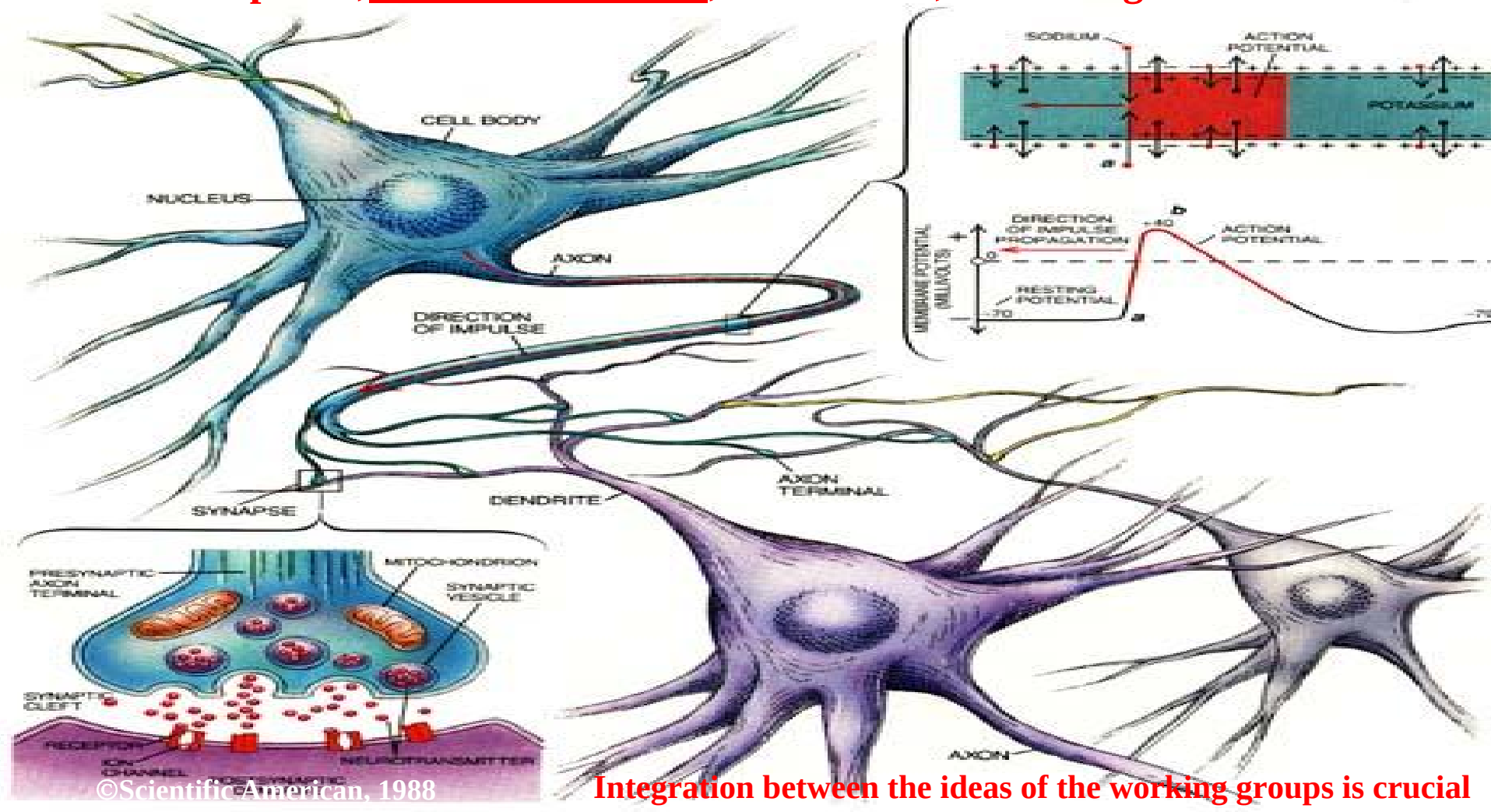
To better understand brain function, advances in available measurement & engineering toolsets are needed

Group of Measuring the Brain from synapse to thought

Irv Epstein; Chris Gall; Martha Gillette;Lingjun Li; Anna Lin; Tom Meade; Gordon Shepherd;Jonathan Sweedler; Harold Szu; Mark Wightman



Integration between the ideas of the working groups is crucial

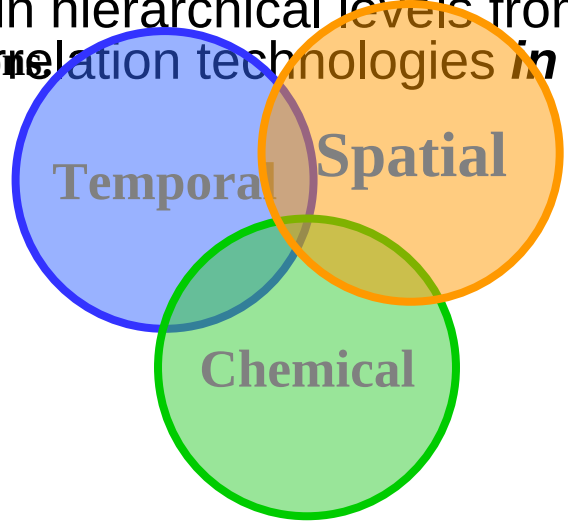
Measuring the Brain: from Synapse to Thought

WHY NOT!:

- Decade of Brain: 1990-2000 (terminated after G. Bush lost re-election)
- Homan Frontier Sciences:1995-2005 (fragmented since US, EU & Asia split),
- 21st Century of Brain 2008-20?? (NSF contemplates with multi-millions, multidiscipline & multi-years deposition of our knowledge in brain science).

WHY NOW?

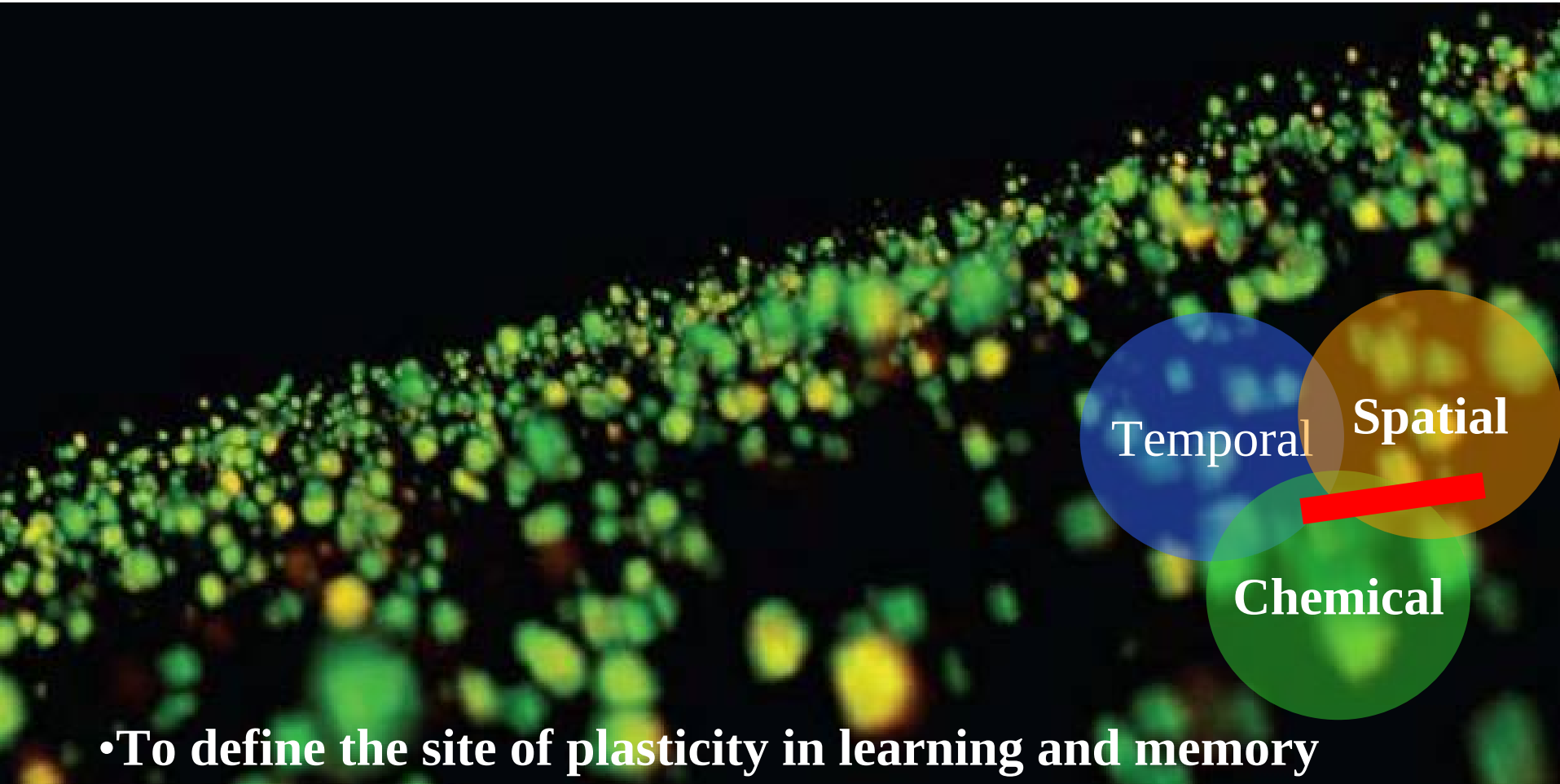
- **Two Decades of Supercomputing** Centers Nationwide.
- **One Decade of National Nanotech Initiative** e.g. nano-p-imaging, nano-robots.
- **Next Gen Internet**, IP4 to IP16 on line 2008
- **Tools for measuring the brain** can attain integration of **time, length and chemical resolutions in vitro**. Questions remain in hierarchical levels from neurons to neurotechnology in spatial and temporal correlation technologies ***in 3D, in video vivo***.
  - **Optical Imaging** with improved multimodal coregistration
  - **Chemical Imaging of a greater range of compounds**
  - **Holistic Imaging in whole, living animals**
  - **Multi-level Analysis from organism to subcellular**
  - **Multimodal analysis with coregistration**
  - **Elucidate Intelligence mechanisms by tools**
  - **Systems biology deals with multiple time and length scales**
  - **Atlas of the brain, from RNA, proteins to small molecules**



Measuring the Brain: from Synapse to Thought

WHY NOW? **Tools for measuring the brain have advanced to the point where measurements can be made with time and length resolutions previously unattainable. The future lies with improved multimodal measurement technologies in vivo.**

- **e.g. molecular tagged imaging of plasticity at level of dendritic spines**

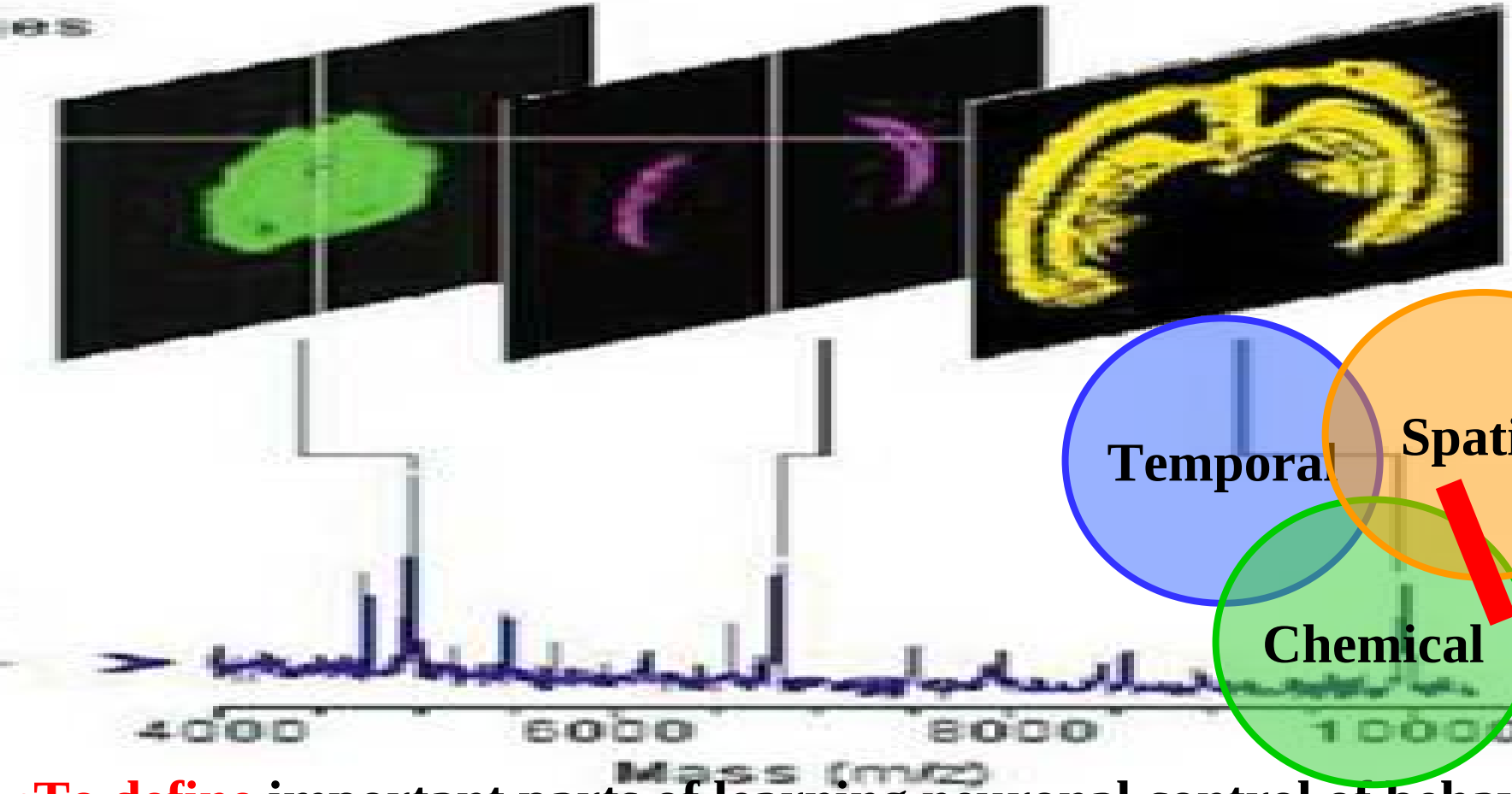


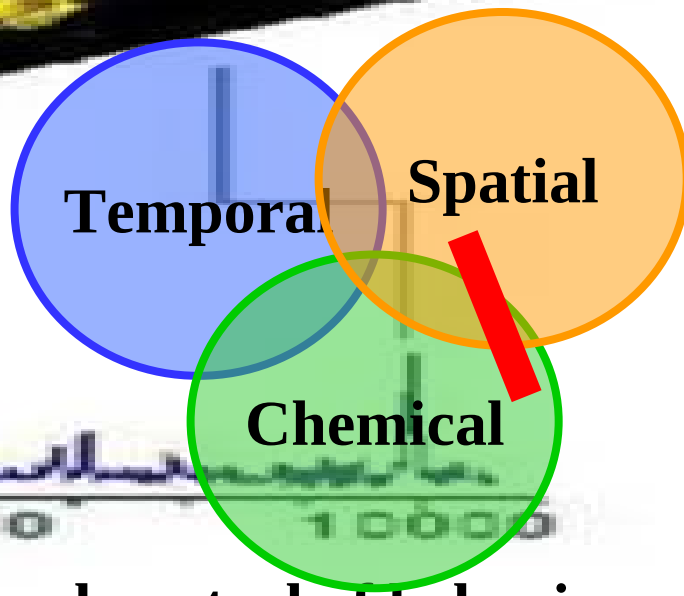
- **To define the site of plasticity in learning and memory**

Thought

WHY NOW? Tools for measuring the brain have advanced to the point where measurements can be made with length and chemical resolutions previously unattainable. The future lies with improved multimodal measurement technologies in vivo in video.

- **e.g. from imaging Mass Spectrometry Chemistry spatial resolution**



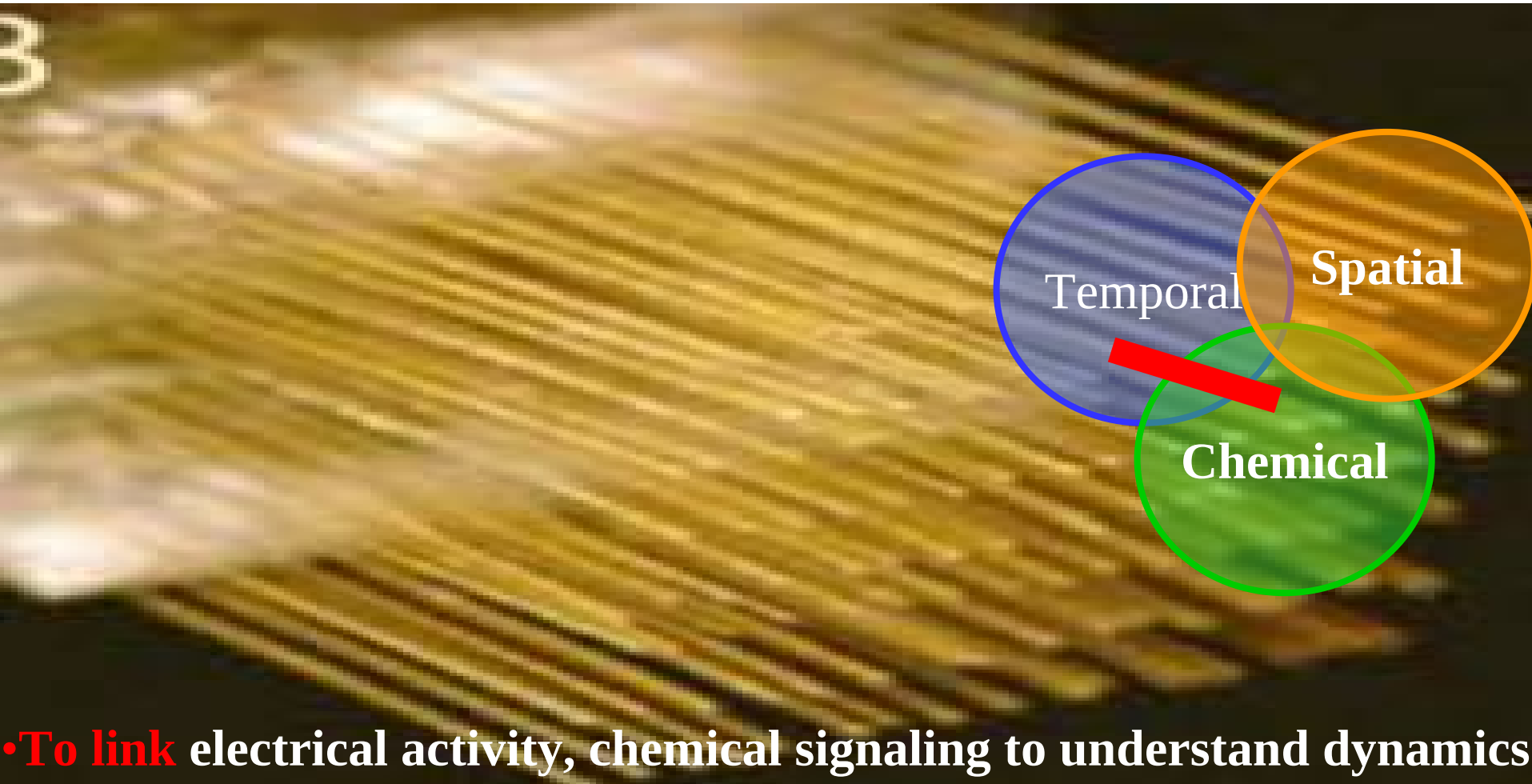


- **To define important parts of learning neuronal control of behavior**

Measuring the Brain: from Synapse to Thought

WHY NOW? Tools for measuring the brain have advanced to the point where measurements can be made with time and chemical resolutions previously unattainable. The future lies with improved multimodal measurement technologies in spatial dimension.

- **e.g. from microelectrodes to sensor arrays for neurotransmitters**

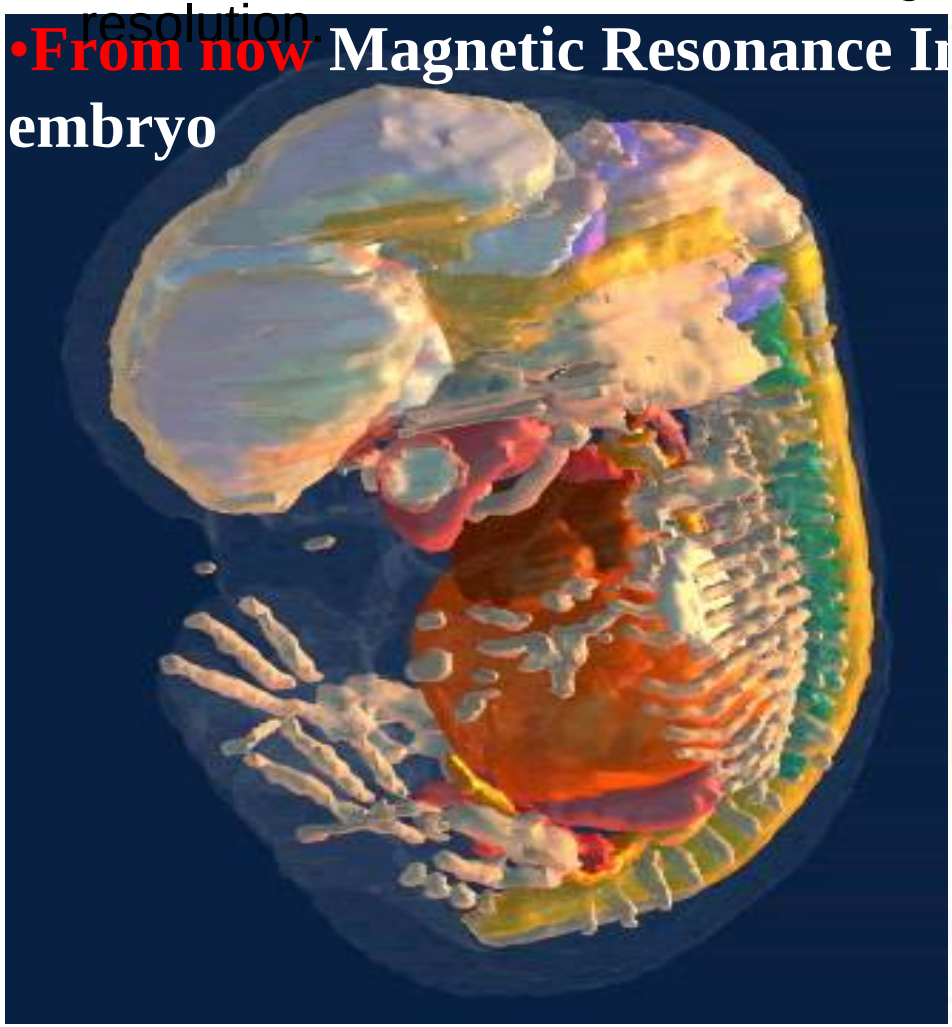


- **To link electrical activity, chemical signaling to understand dynamics**

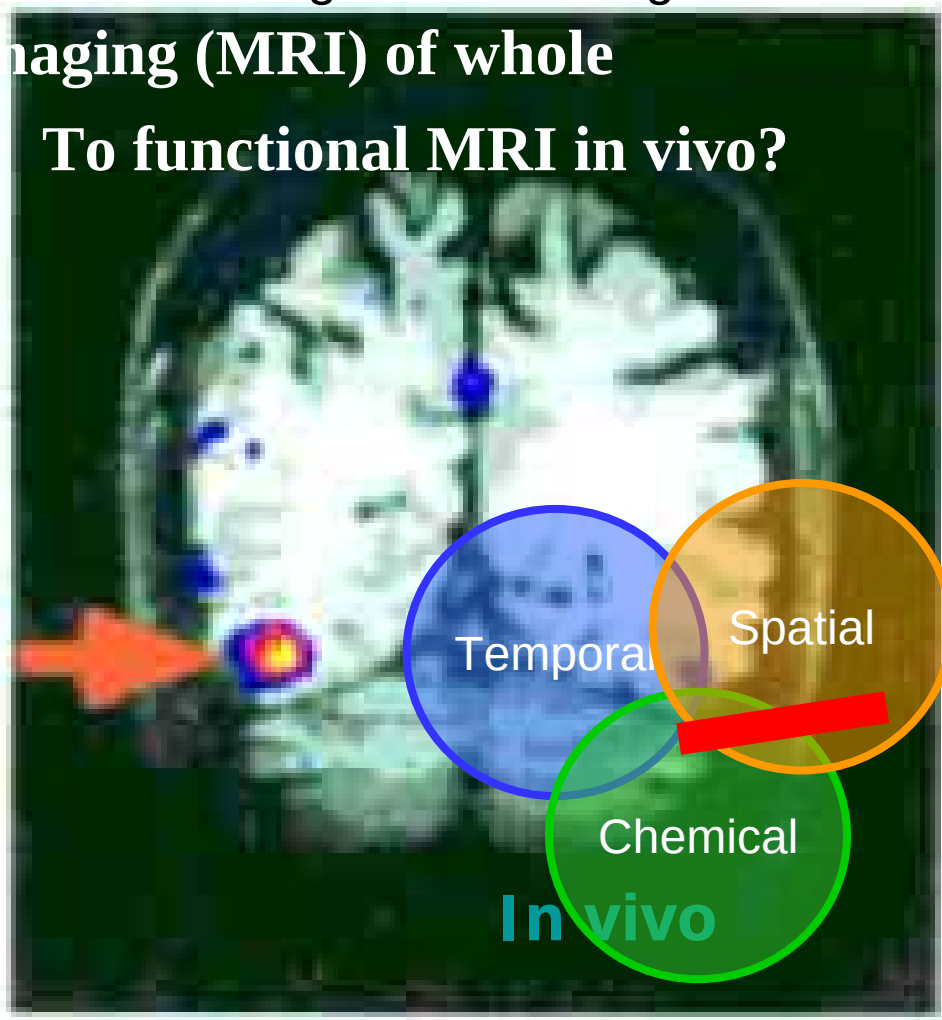
Thought

WHY NOW? Tools for measuring the brain have advanced to the point where measurements can be made with time, length and chemical resolutions previously unattainable. The future lies with improved multimodal measurement technologies in whole organism with higher resolution.

•**From now** Magnetic Resonance Imaging (MRI) of whole embryo



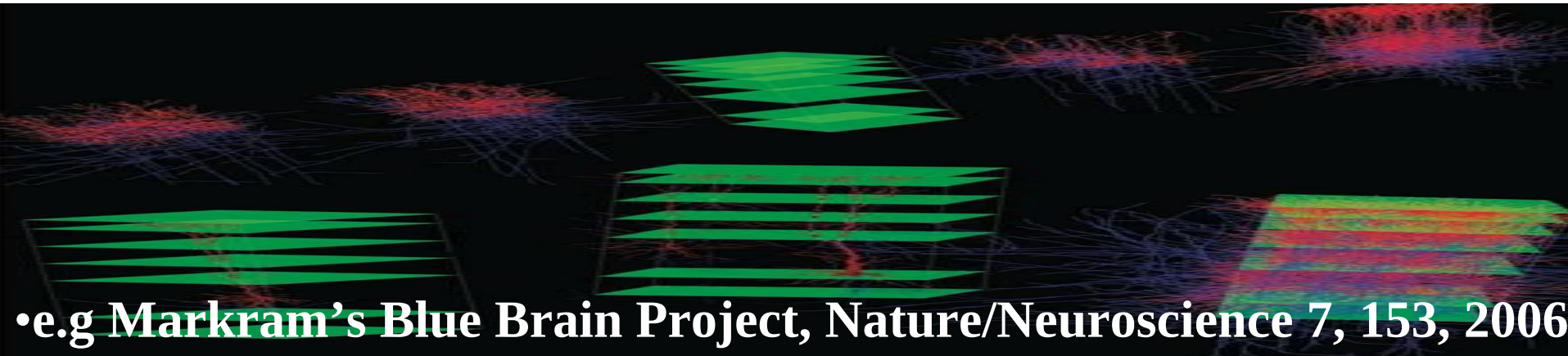
To functional MRI in vivo?



•**To elucidate** beyond Blood Oxygen Level Difference (BOLD) signal?

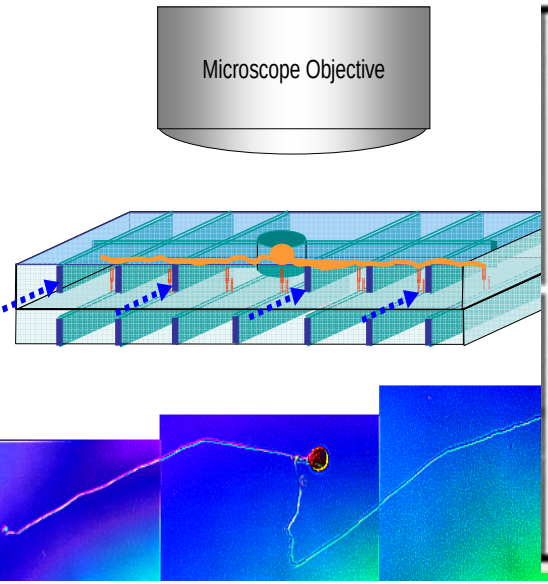
How do we analyze, use the data we acquire?

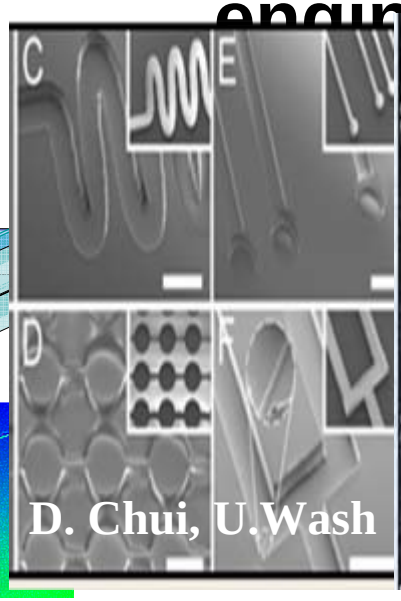
- **Need new math statistical methods to analyze immense data**
  - Filtering out insignificant data?
  - Fusion multiple time and length scales
  - Automatic Pattern Recognition
  - Classification of features into classes and comparison
  - Interpolation & Extrapolation of incomplete data sets
- **Need data sharing and archiving at NGI/Supercomputing Centers**
  - At the national level to support experiments and simulations
  - Long term commitment needed to replace Human Brain Project
  - Hierarchical levels of data needed
  - Integrate across different animals:invertebrates & vertebrates



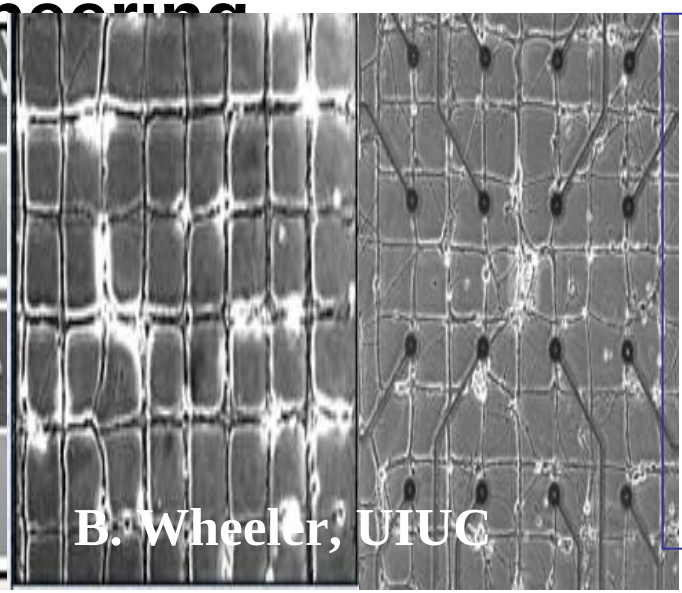
•e.g Markram's Blue Brain Project, Nature/Neuroscience 7, 153, 2006

Reverse engineering the brain:elucidating new designs, new methods of neuronal control, to tissue engineering



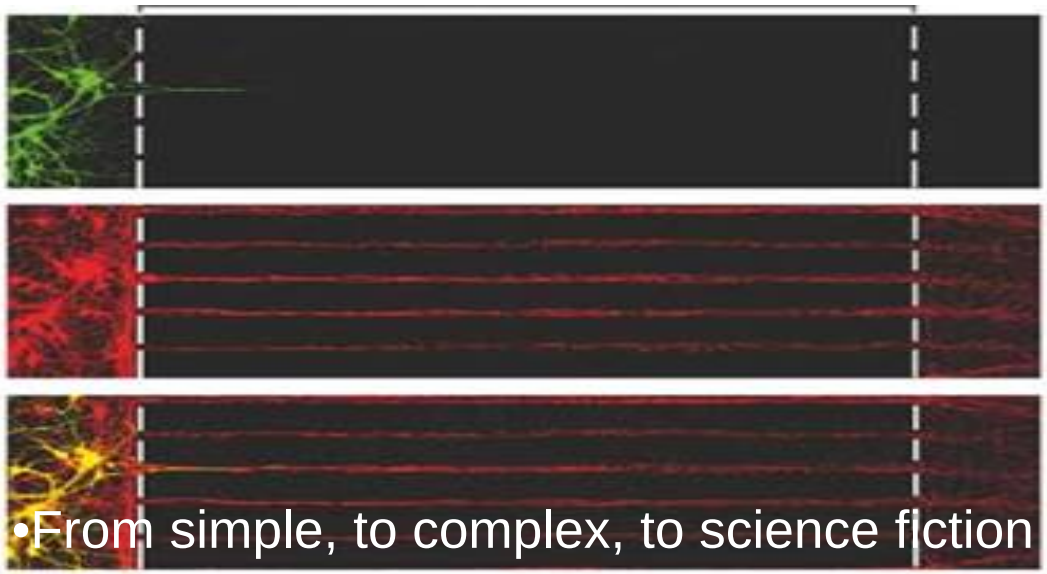


D. Chui, U.Wash

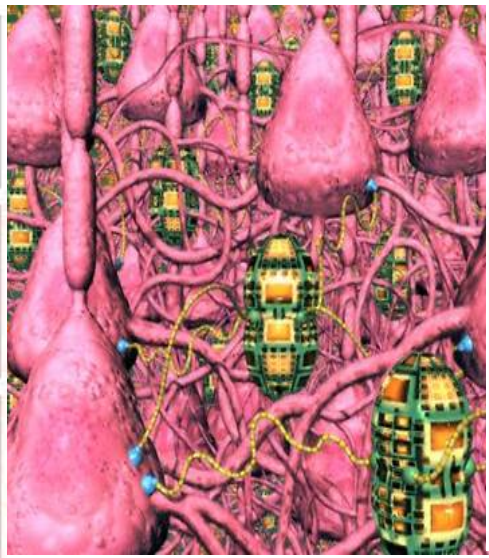


B. Wheeler, UIUC

H. Szu, et al. video imaging of 3 neurons “Peter, Paul, Merry ” singing together on electronic chip Neurocomp. 1994*Neurocomput ing*, vol. 8, no. 1, p p. 1-9, Jan. 1994



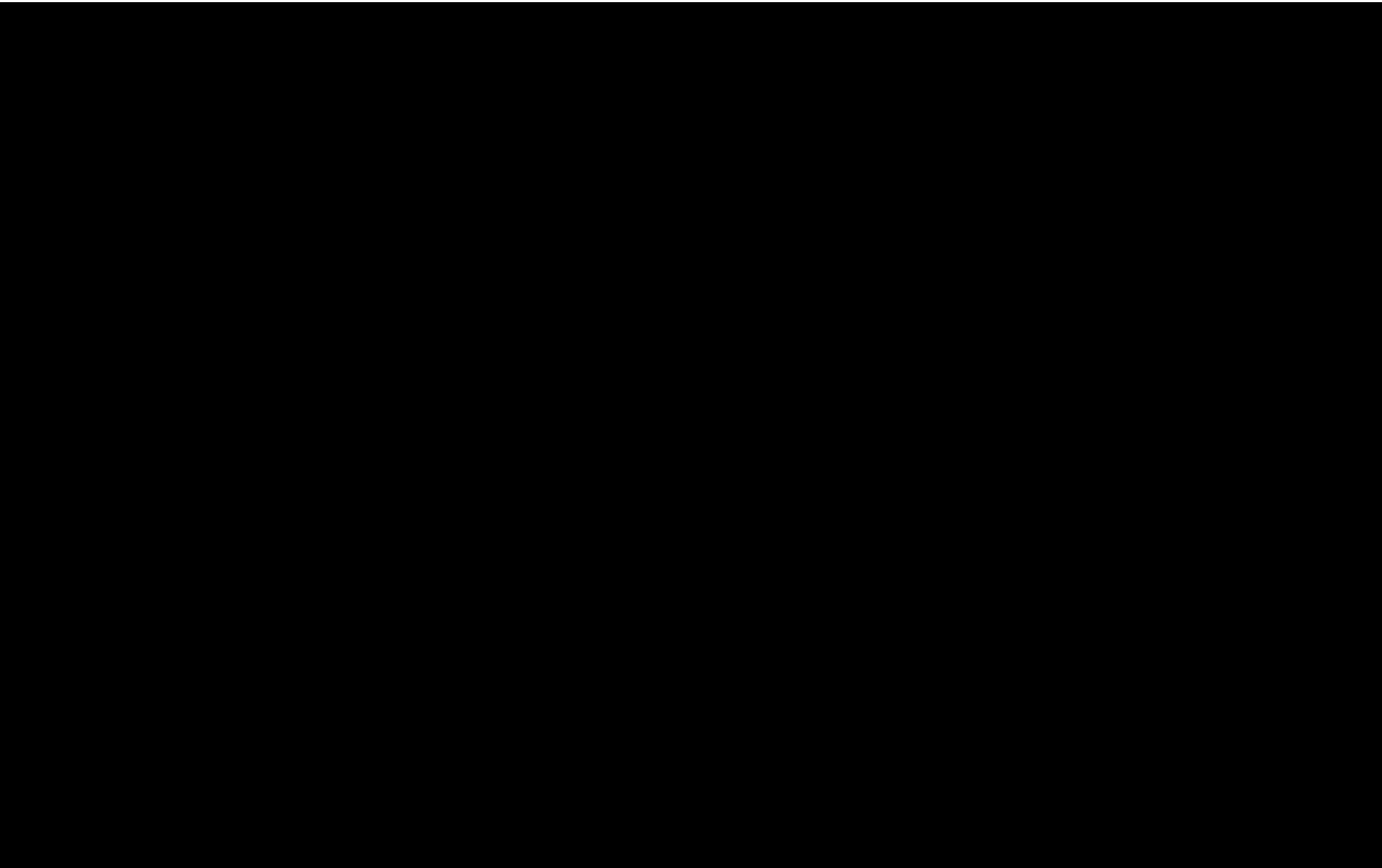
•From simple, to complex, to science fiction



www.nanotech-now.com/Art Gallery/tim-fonseca.htm

Noo Li Jeon’s group, Nature Methods, **2**, 599 , (2005)

H. Szu, et al. “Live Neural Network Formation on Electronic Chips” video imaging of 3 neurons “Peter, Paul, Merry ” singing together on electronic chip Neurocomp. *Neurocomputing*, vol. 8, no. 1, p. p. 1-



It's the People, People, and People!

Promote cross-training across disciplines in multiple tenures

While NSF training opportunities exist, they tend to be divisional or disciplinary and locked-in.

How to remove barriers & level the play field

•Graduate student training plans outside of centers or defined plans
•Postdoctoral training across fields
•Release time for faculty to study in a new discipline

Special NI Projects

- Swarm Team of UAVs
- Powerless Power Line Communication
- Machine IQ for consumer products
- Next Gen Internet Search Engine

Navy team of mini-UAVs

- Payload limitation of EO/IR sensors without Gimbals using HVS software de-jittering
- 3D Synthetic Aperture Radar at L band each mini-UAV uses GaAs cellular phone Transceiver as an aperture of EM(x,y,z,t)

Unique micro-UAV advantages are inexpensive, covert, distributive, and yet network-centric sensor suite fusion for surveillance com-link.

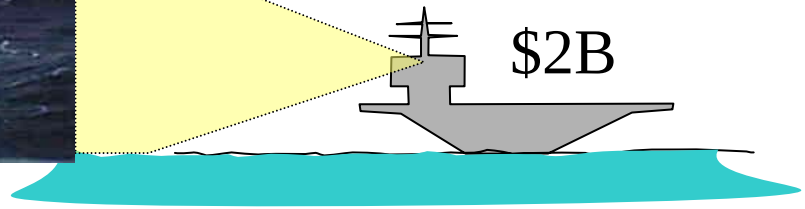
Its unique challenges are the size, weight, power, which translate to fixed sensors mount suffering the aerodynamics motions, jittering using low power on-board processing and C4ISR off-board decision aids.

How to increase Stand-off Distance of Missile Defense?

In-situ mini-UAV can give OTH carrier's scouting needs, but the payload can not use cryogenic multispectral imaging.

Coverage:

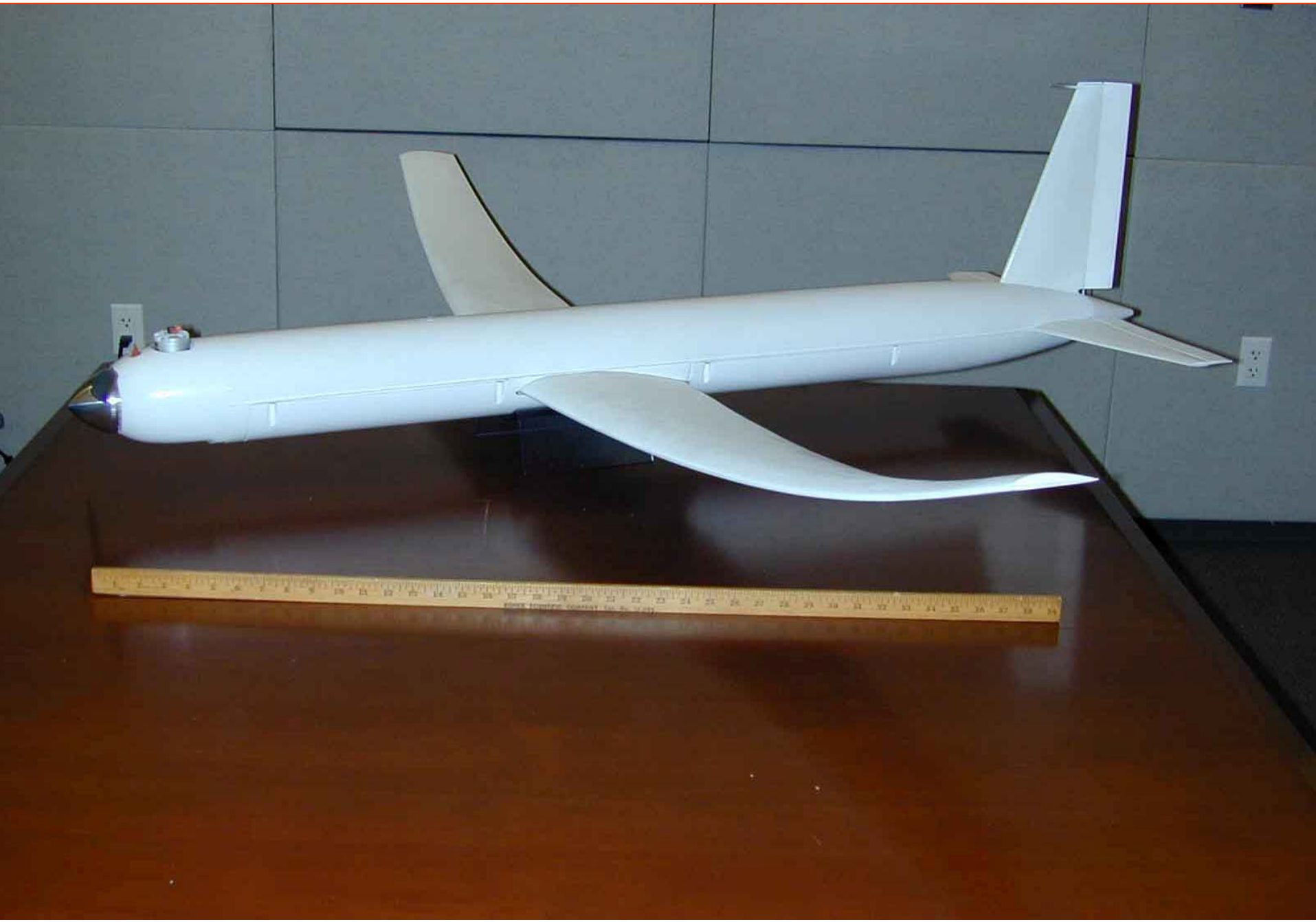
- ***360-degrees-horizon***
- ***48 kilometers Range (26nm)***
- ***UAV within 1 nm***

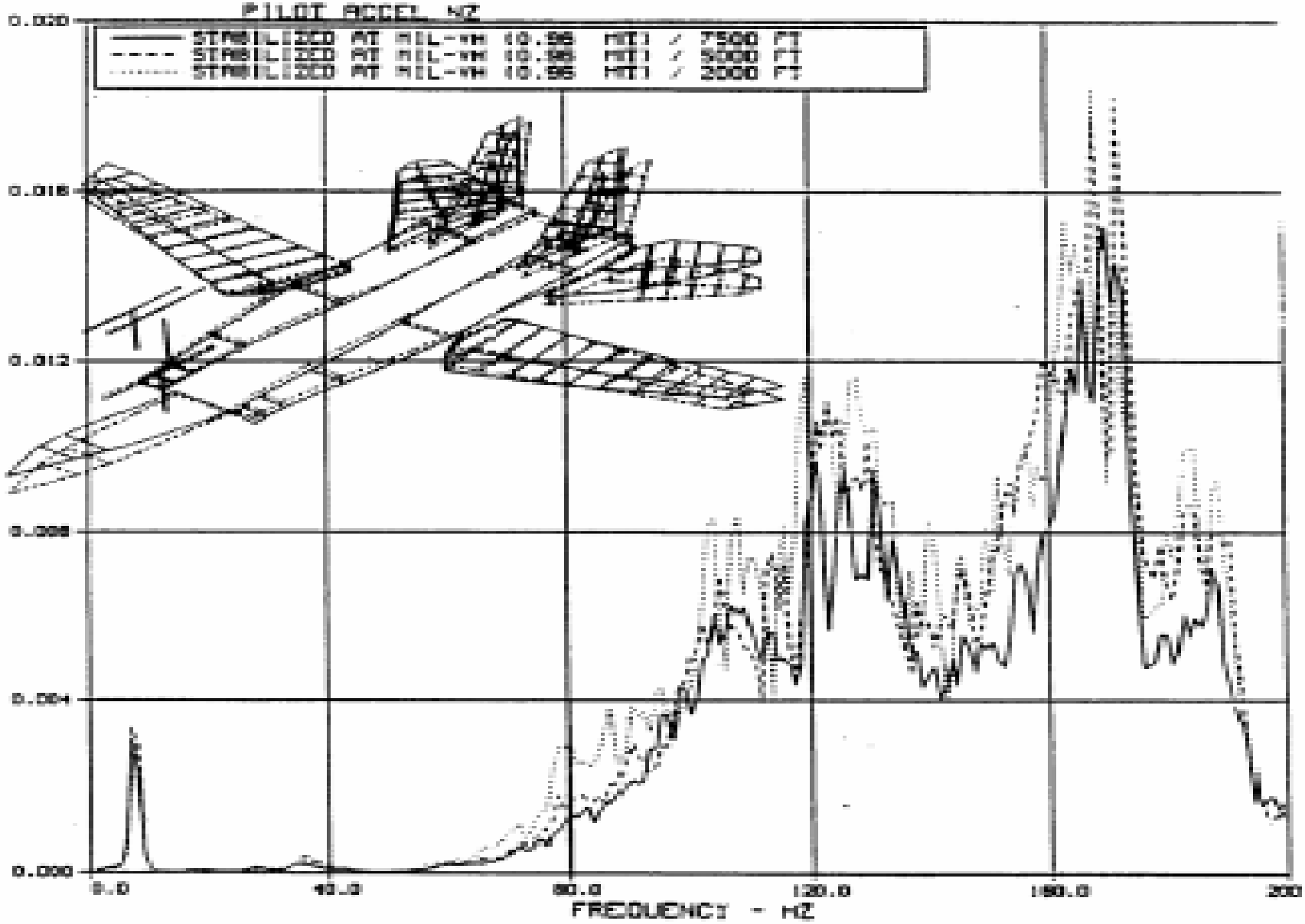


•UAV can steer itself by means of Long IR FPA to point at incoming cruise missile plume looking for unique feature at Mach cone turbulent mixing range dependence of CO-CO_2 Mid-IR spectral lines.

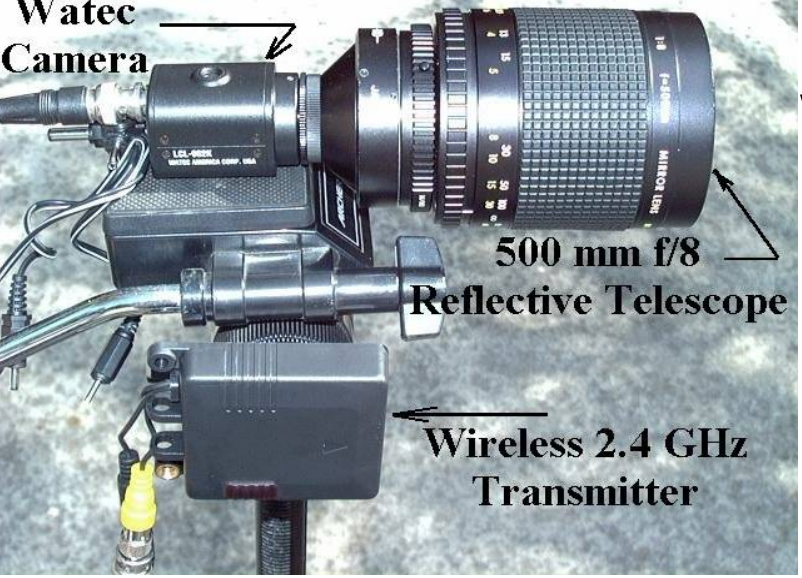
•Thus, FNC platform protection can increase the standoff distance by unsupervised fusion in terms of two color IR by UAV as X-band Radar can not yet see OTH missile due to the earth curvature ocean waves.

Platform Resource Constraints: no gimbals mounting for EOIR-RF





From pg 30 & 40 of
Grumman Aerospace Corp., Report No. LD-303D-89-002



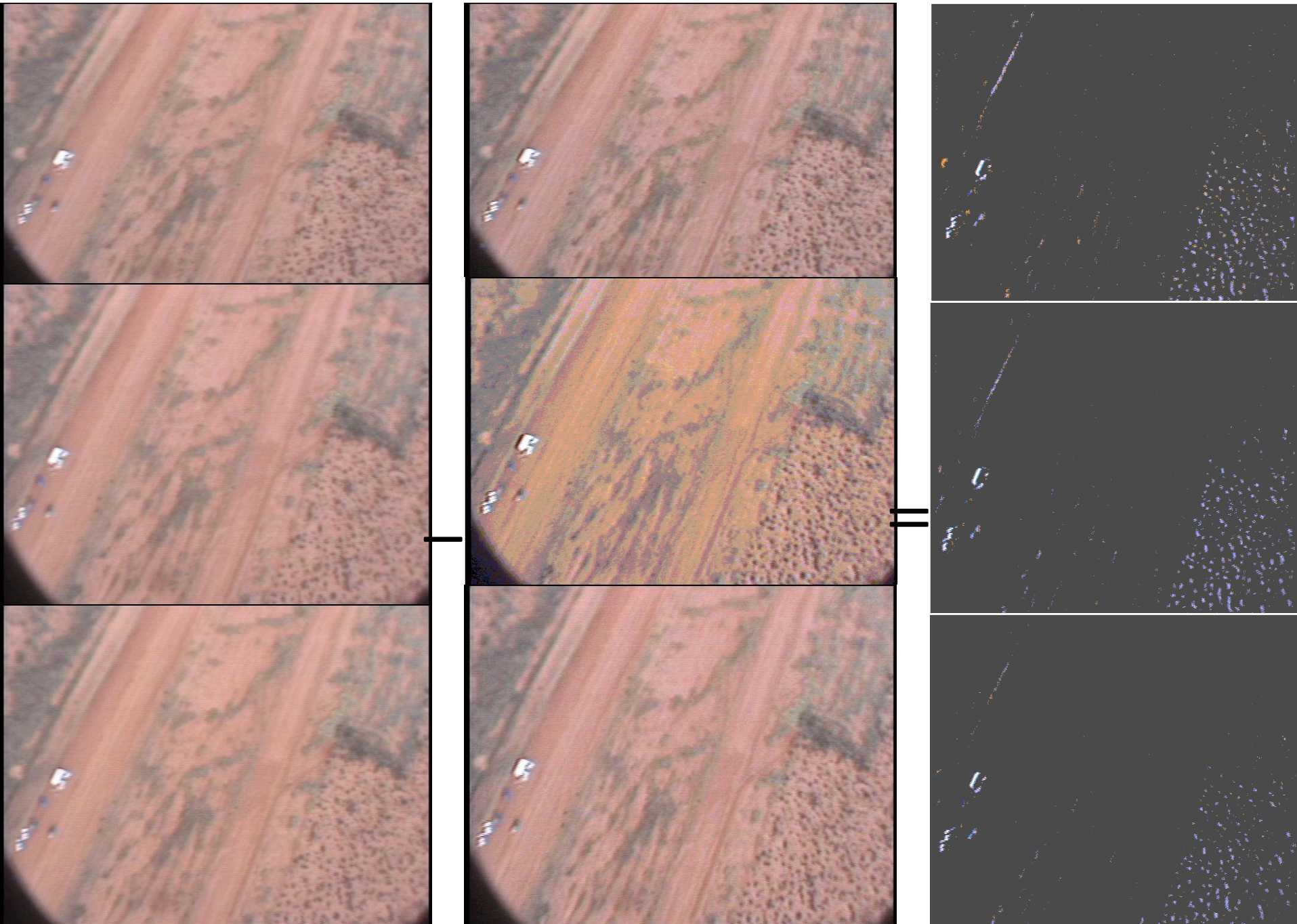
Why video sub-pixel jitter correction is important?

•We define jitter to be sub-pixel or small-amplitude vibrations up to one pixel, as opposed to motion blur over several pixels for which there already exists real time correction algorithms used on other platforms.

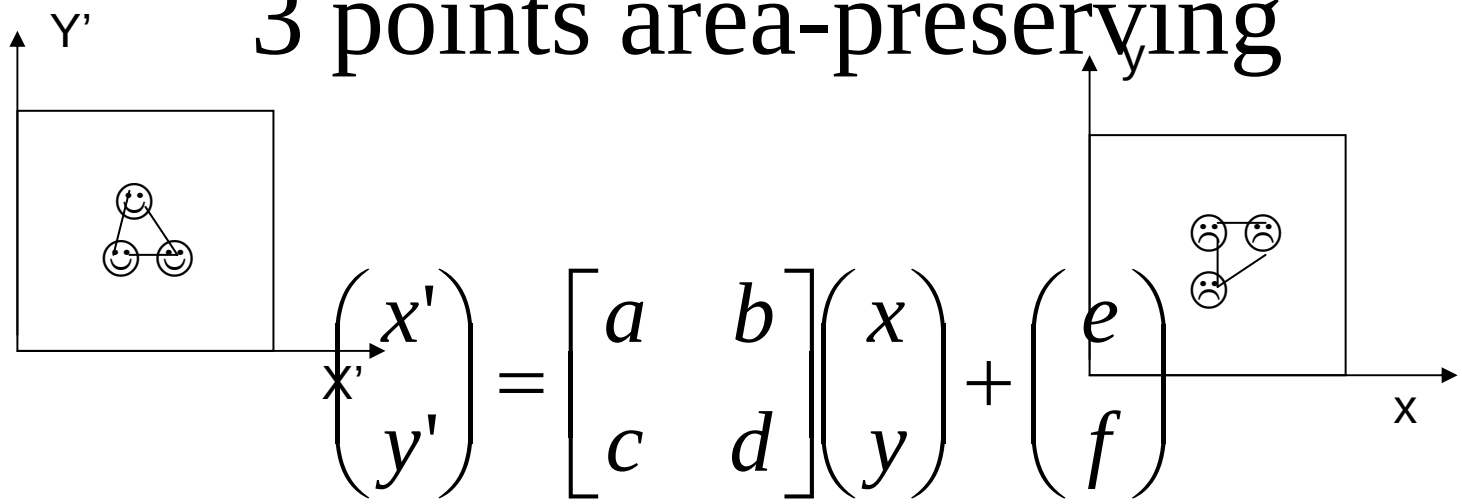
•Since micro-UAV, Silver Fox, cannot afford Gimbals mounting from the isolation coupling to the turbulent aerodynamics of the airframe, we must explore **real-time unsupervised learning software** on board of μ-UAV to mitigate the sub-pixel jitter effect.

•The sub-pixel accuracy is the basis of affine distortion transform and passive cell-phone transceiver array one per UAV for interference SAR registration.

m-UAV sub-pixel jitter Algorithm by Szu: ***“agree, signal; not, noise”:***



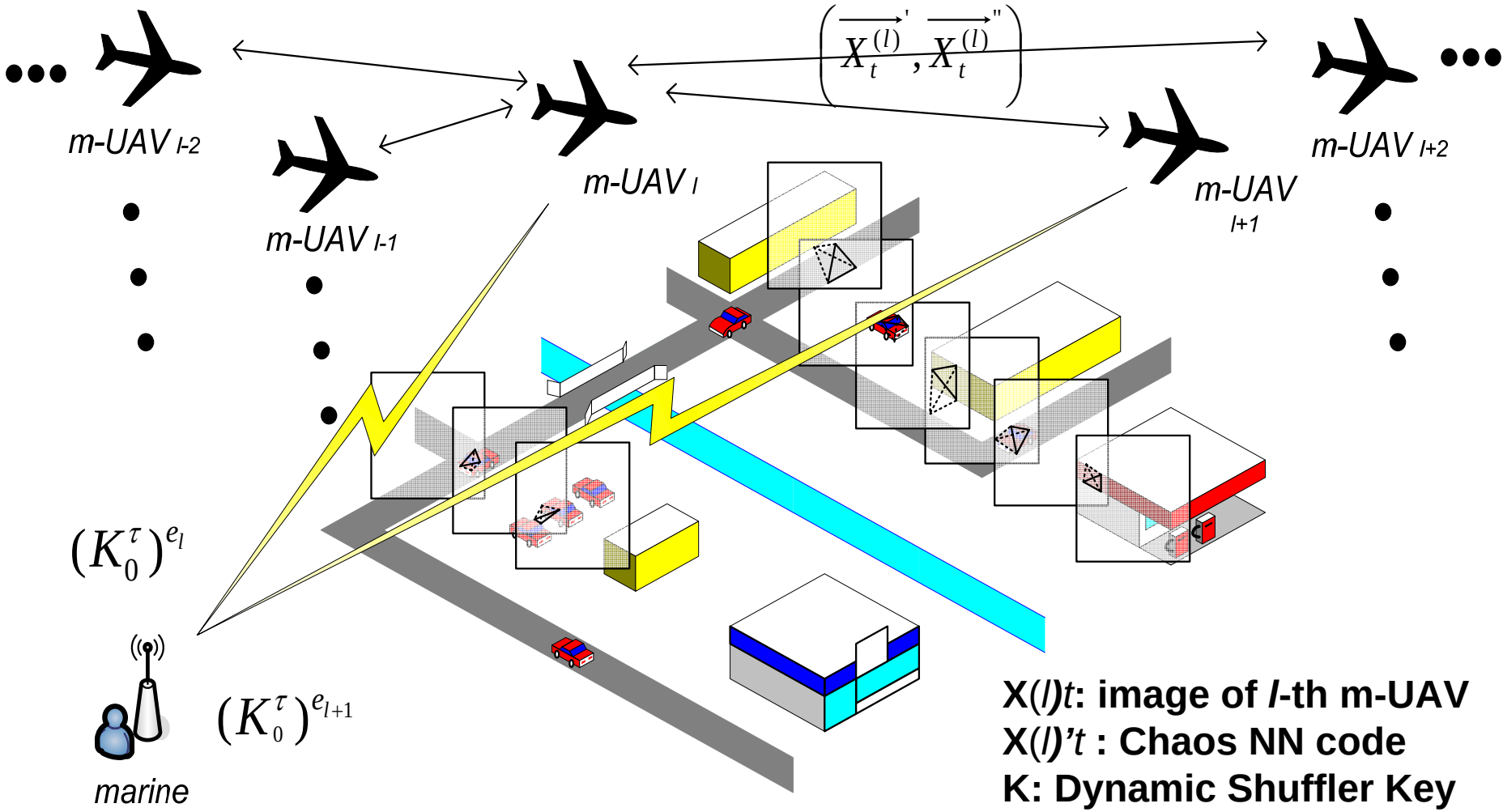
Cooperating Surveillance distortion registration by simple Affine Transform 3 points area-preserving



$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} e \\ f \end{pmatrix}$$

Scatters of inexpensive plastic disks having both optical & thermal signatures provided the required minimum three correspondent points in neighborhood frames (over-determined case is given by Szu 1980). Then, location of approximate centers of scatters is geo-registered.

Authenticated Private Secure (APS) Chainsaw Communication
A minimum of 5 m-UAVs requires security; but "no man, no NSA"
Jittering Mosaic Image Processing (Szu et al. SPIE ICA etc 2006)



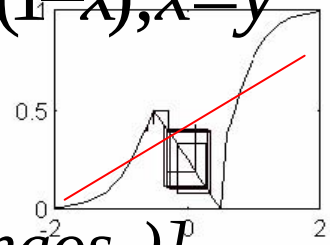
X(*l*)*t*: image of *l*-th m-UAV
X(*l*)'*t* : Chaos NN code
K: Dynamic Shuffler Key
X(*l*)*t*": hashed chip

APS protected Pair-wise Privacy by Chaotic NN

Messages encrypted by CEP

The mixed image

$$y = f(x) \equiv 4\lambda x(1-x), x = y$$



Binary Message

Carrier of Message

$$M' = EXOR[M, Chaos] = Mod_2[B(M) \oplus B(Chaos)]$$

$$M = EXOR[M', Chaos] = Mod_2[B(M') \oplus B(Chaos)]$$

Rivets, Shamir, Adelman (RSA) codec N = pxq two primes; e.g., 15 = 3 x 5; (1)

(I) x (p-1)x(q-1) + 1 = e x d; public x private; 1 x (3-1) x (5-1) +1 = 3 x 3; (2)

Coded message M'= L = remainder [M^d/N]; (3)

Decoded retrieval M = remainder [L^e/N]. (4)

For example: M= "Chaos typing & initial seed is on page 3"

Given a message, say ASCII "C" = 3;

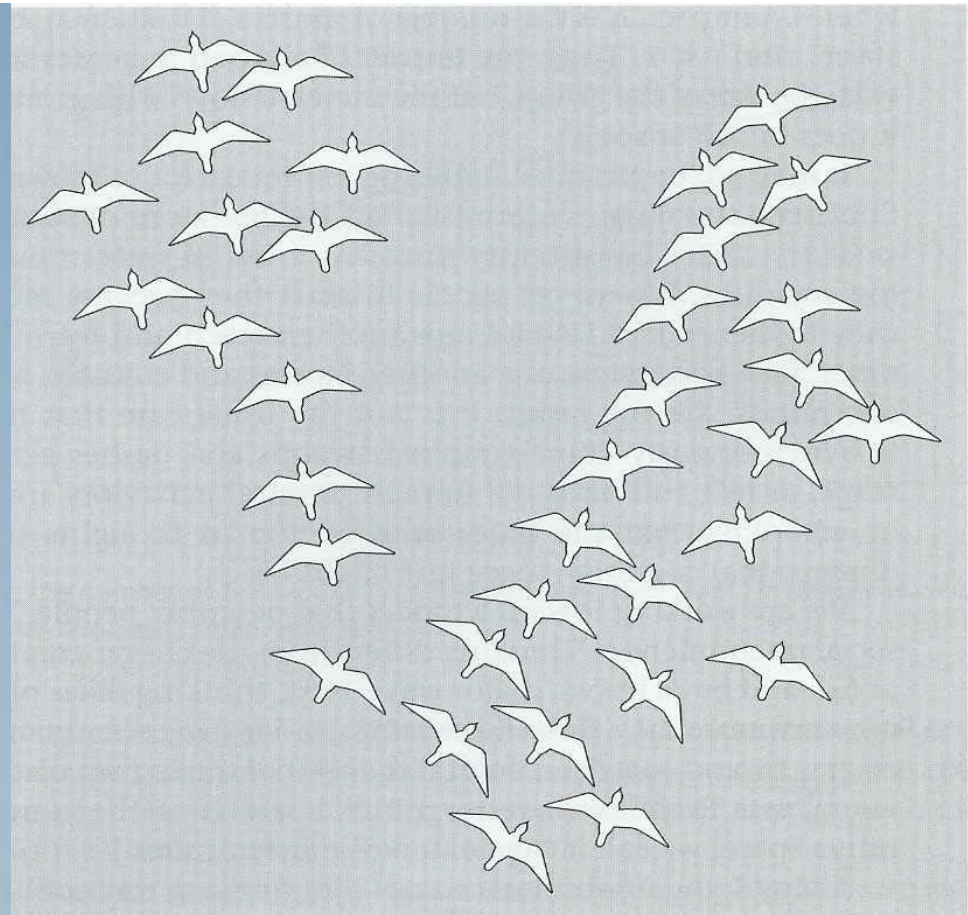
Coded M'=L= remainder [3^3/15] = [27/15] =12;

Decoded M = remainder [12^3/15] = [1728/15] = [115+3/15] =3.

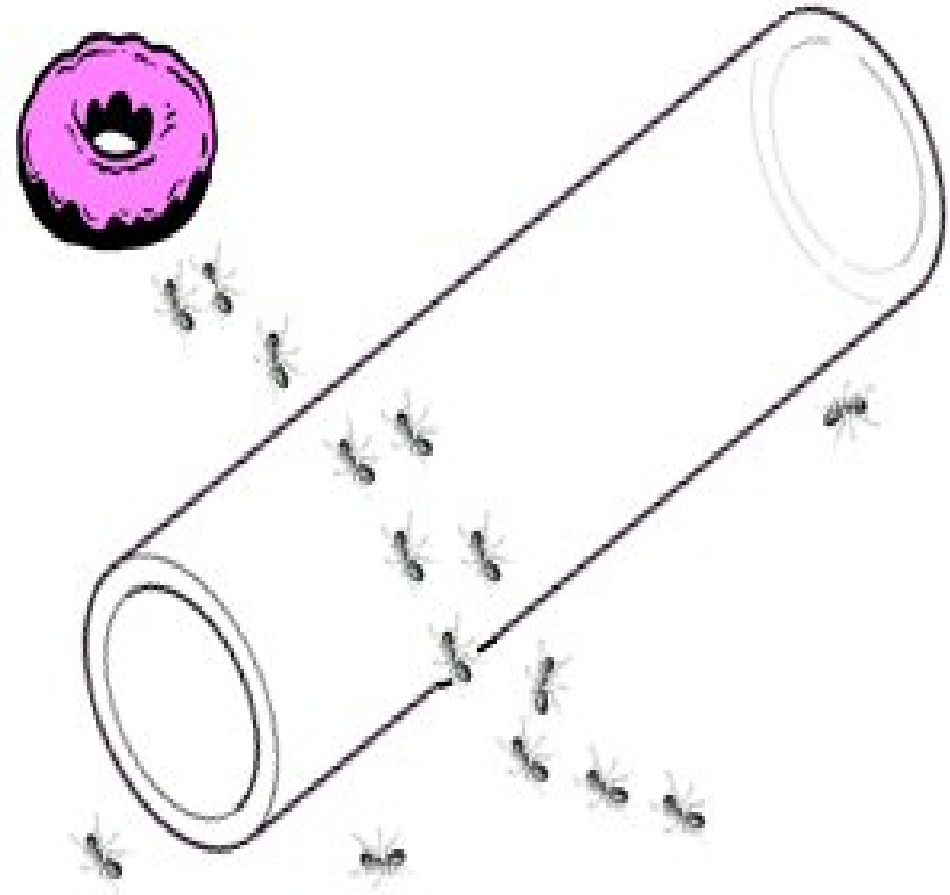
Chinese Remainder Theorem & Square & Multiplier Lookup Table are used. QED.

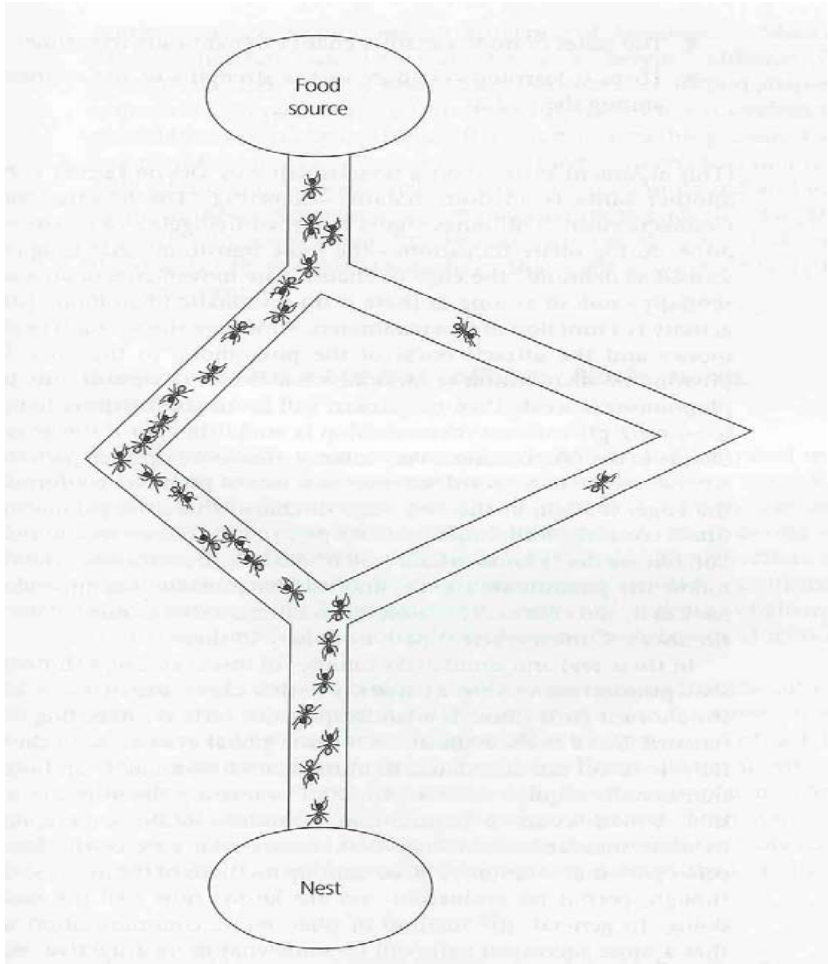
Swarming Intelligence: What is the minimum communication of each node required to make collective behavior more intelligent?

The swarm intelligence in bird migration is based on three interaction principles: moving to center, maintaining the same speed, and avoiding collisions.



Ant’s solve TSP because pheromones accumulates more on shorter path since ant sets out on that returns faster





Fusion Novelty Detection

Blind **S**ources **S**eparation (not ICA)

US Patent Navy Case 8380 Szu, et al. on thermodynamics 4 equations.

Unknown source components $\{s_i\}$ inverting unknown matrix [A] by ANN weight matrix [W] have numerous solutions pairs sensor data vector **X = [A?] S?** *per pixel* (1)

The unique one is postulated to the minimum thermodynamic free energy ***H*** pixel-by-pixel min. $\boldsymbol{H = E - T_o S}$ (2)

The information energy is assumed by Szu as an analytical function of I/O in terms of the first order estimation error energy E valid for weak signals $E = \mu .([W]X - S?)$ (3)

(pixel-by-pixel μ-Lagrange vector): *minus the useless sources entropy of Shannon:*

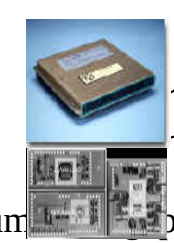
italic $S = -\Sigma_i s_i \log s_i + (\mu_o+1)(\Sigma_i s_i - 1)$ (4)

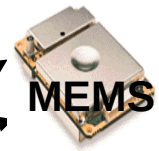
(plume temperature parameter T_o is determined by a uniqueness requirement of the minimum H)

DARPA MOSIS to OSD MEMS & to USA NEMS Found

Why MEMS? Possible Consumer Electronics

"XYZ on Chips" bio-sniff requires vacuum pump,
parallel sampling plastic ducts via MEMS & NEMS!





Maintenance "free" per season:

Robust MEMS & NEMS for sensor platform integration with molecular quantum[illegible]o material

Interface Standardization requires Int'l Collaboration

Meetings regularly in NEMS and low-noise sensitive ChembioNu are needed to stimulate R/D.

•Standard Interfaces are required to encourage the volume high yield 0.1% to 25% production for the cost reduction of various ChembioNu detectors via optical, electrical & mechanical changes

•NEMS & MEMS Foundries demanded for university R/D, similar to early MOSIS

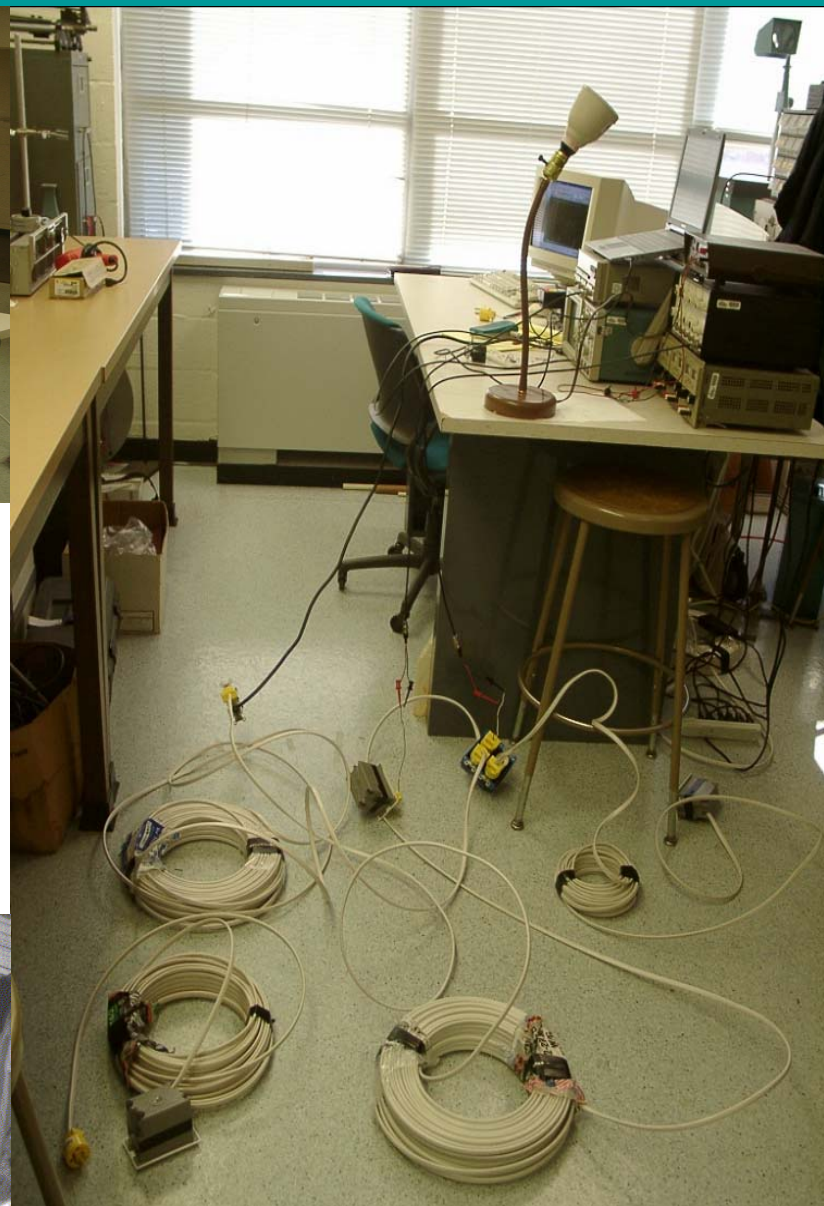
•Government, Academia and Industry Cooperation for dozen Foundry:

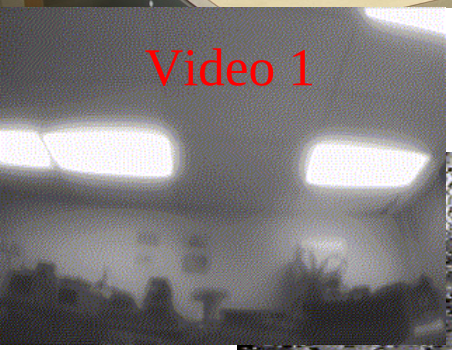
•Heavy Activities exist at Special Purpose Applications R/D
•Commercial Applications are only limited by imaginations.
•Leverage Governmental Needs through grants etc.
•No specific effort in advancing MEMS, except few agencies.

New Era of Economic Boost via Nano-Micro Commercial Applications:

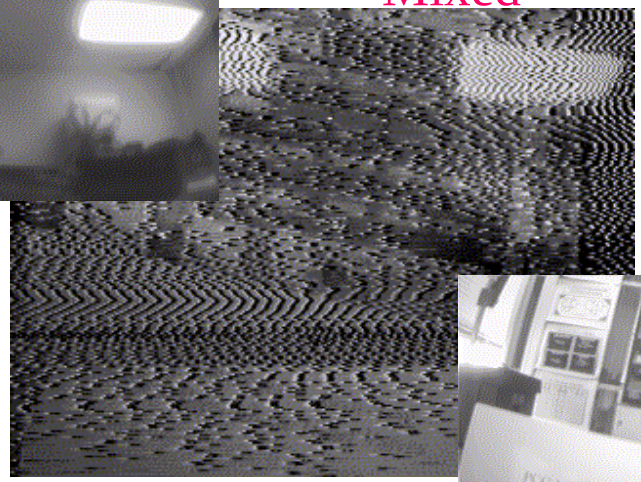
•High g inertial motion guidance requires large proof size/mass ratio
•Generic approaches are capacitor, piezoelectricity, optics path changes
•Integration of GPS with IMG is missing for compact recreation and navigation usage
•Optical wavelength Switch for Communication
•Household IR Spectrum Thermometer, CO and fire detection, and supermarket fish/ meat freshness

Experiments at Digital Media RF Laboratory



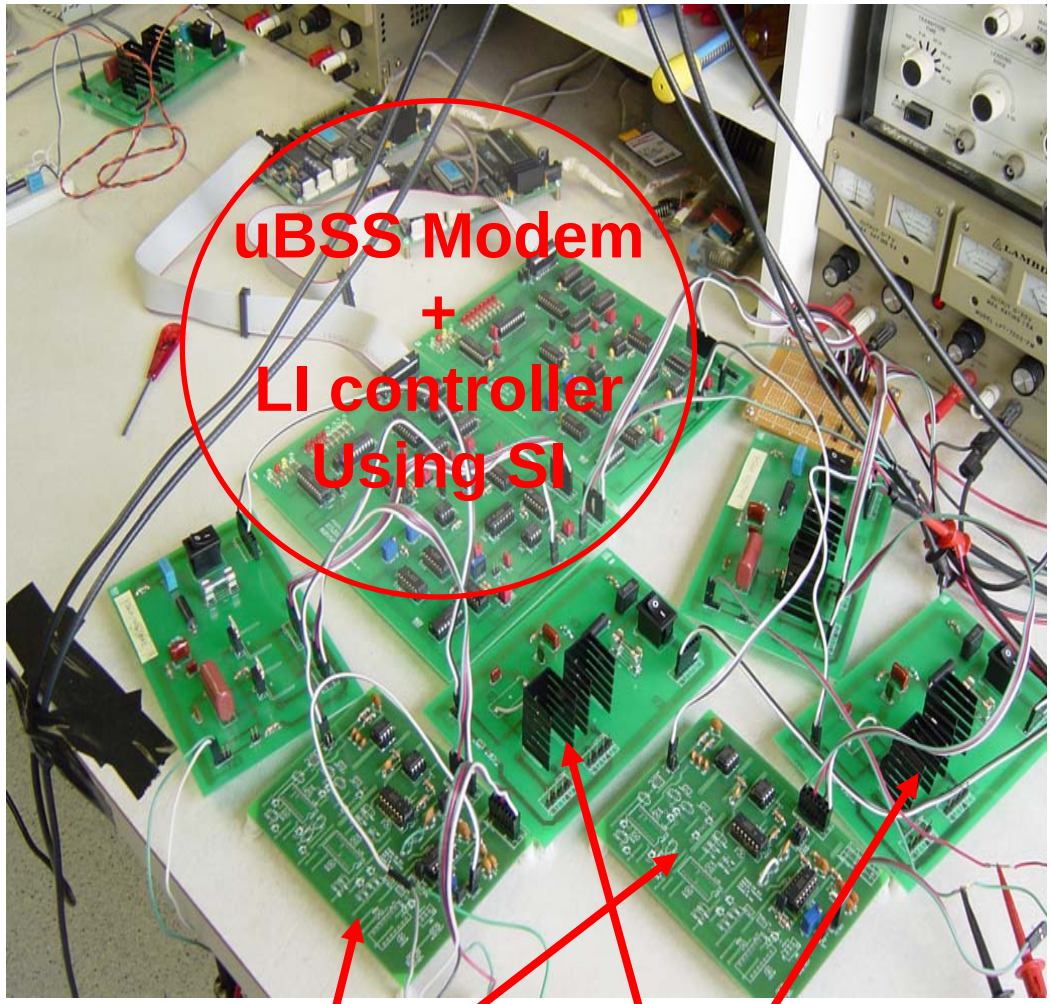


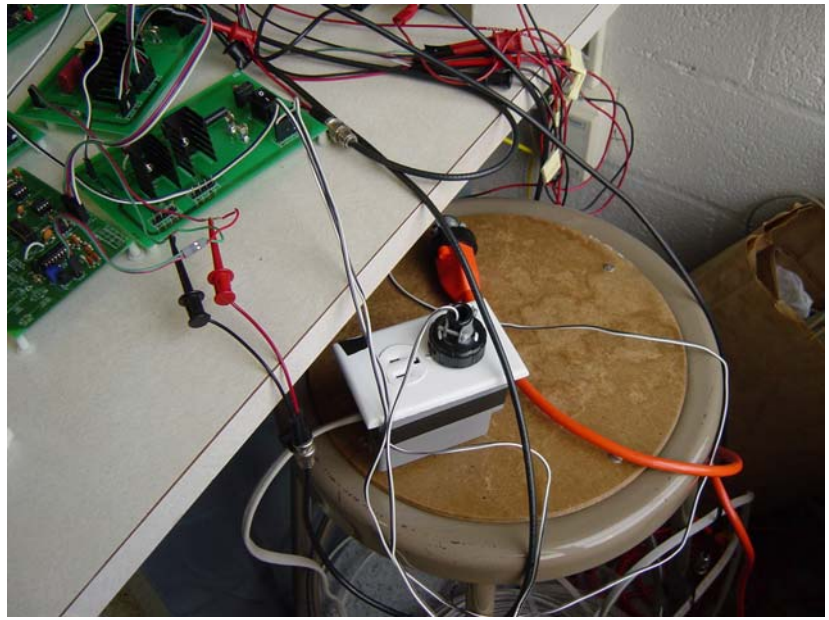
Mixed

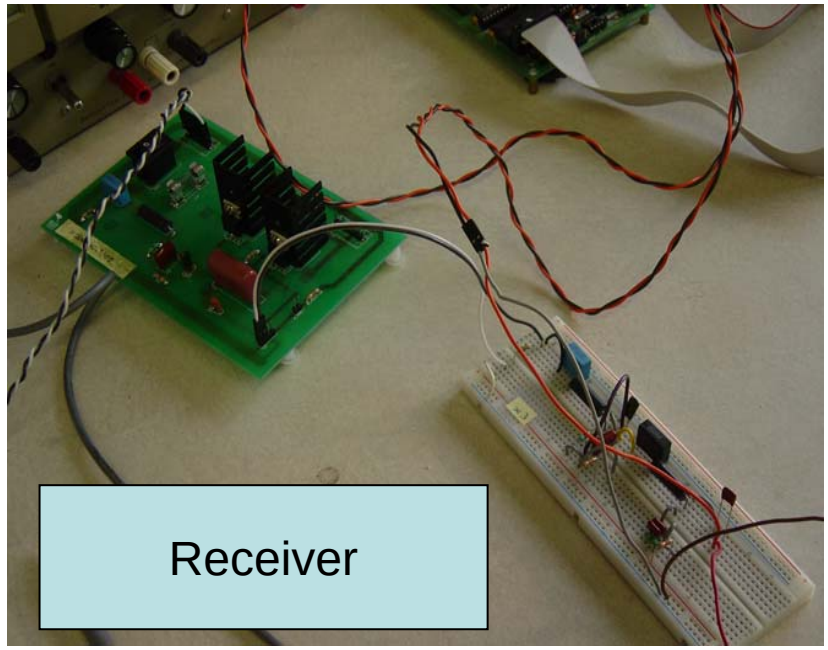


Commercial Products: SeaView

SI Powerline Sensor Network Testbed





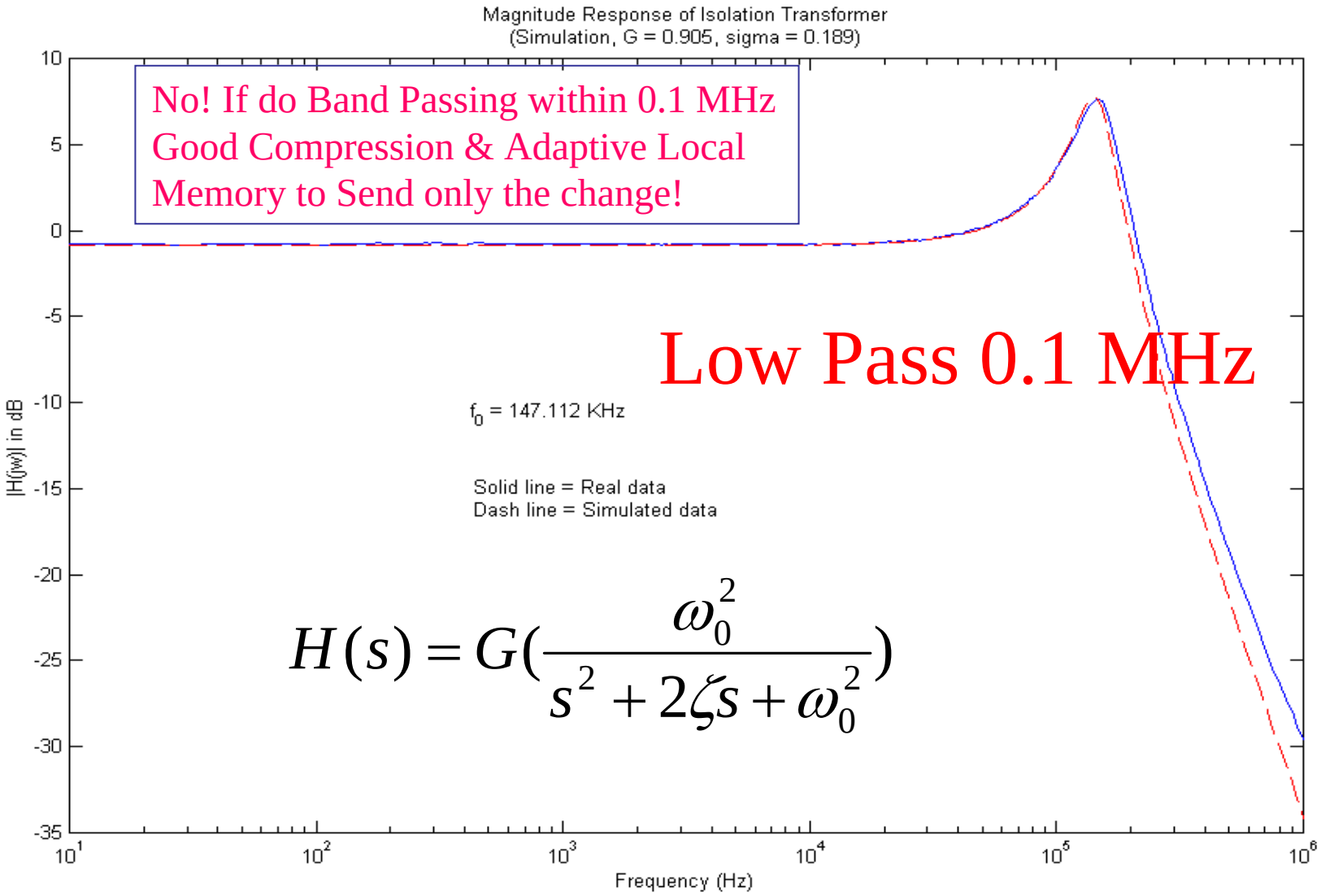


Analog
Front-end

Coupling Circuit

+ Power Supply

Is the Transformer the road block?



$$H(s) = G\left(\frac{\omega_0^2}{s^2 + 2\zeta s + \omega_0^2}\right)$$

Theory: Underdetermined Blind Source Separation (uBSS)

Scalar time series defines underdetermined BSS:

$$x(k) = \langle \vec{a}, \vec{s}(k) \rangle + n(k)$$

$$s_i(k) \in \{-1, 1\} \quad i = 1, \mathrm{K}\ , I \quad \textit{for I source signals}$$

For *Linear Memoryless* system with *one receiver*

Solution e.g. two binary sources, s_1 and s_2: unknown a_1, a_2

1. Take the first moment: $E[x] = \int_{-\infty}^{\infty} x f(x) dx$

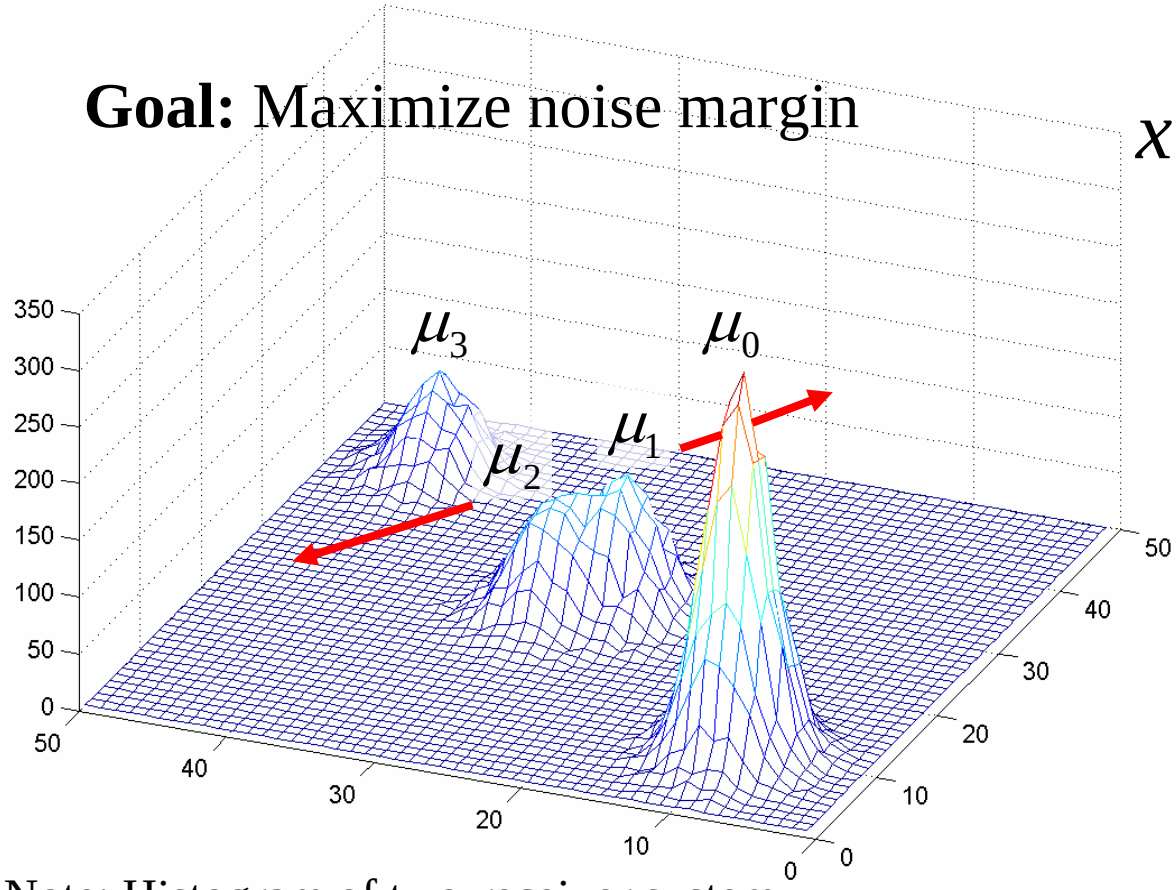
Mixing vector $\vec{a}$ of the system is deterministic and it is not dependent on the source signals $\vec{s}$

$$E(x | \vec{s} = \vec{t}_i) = E(\langle \vec{a}, \vec{s} \rangle | \vec{s} = \vec{t}_i) + E(n) \cong \langle E(\vec{a}), E(\vec{t}_i) \rangle = \langle \vec{a}, \vec{t}_i \rangle = \mu_i$$

Insertion of Loading Impedance (LI)

Goal: Maximize noise margin

$$x(k) = [a_1, a_2] \begin{bmatrix} s_1(k) \\ s_2(k) \end{bmatrix}$$



ϕ = LI factor

ANN: Self-Organizing

Note: Histogram of two-receiver system

$$[a_1, \phi.a_2] \begin{bmatrix} s_1(k) \\ s_2(k) \end{bmatrix} = [a_1, a_2] \begin{bmatrix} s_1(k) \\ \phi.s_2(k) \end{bmatrix}$$

Powerline uBSS Modem: Hardware Realization

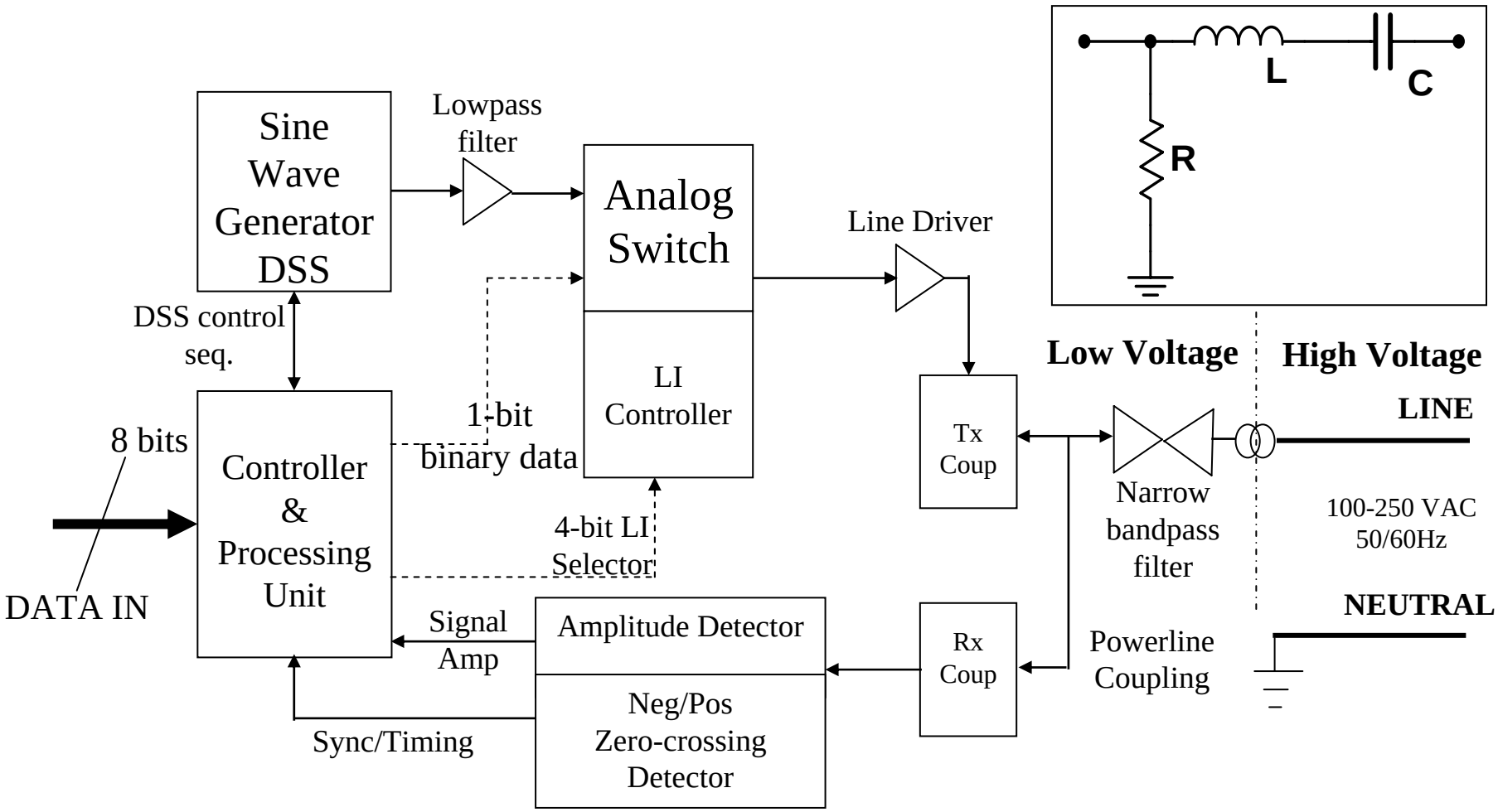
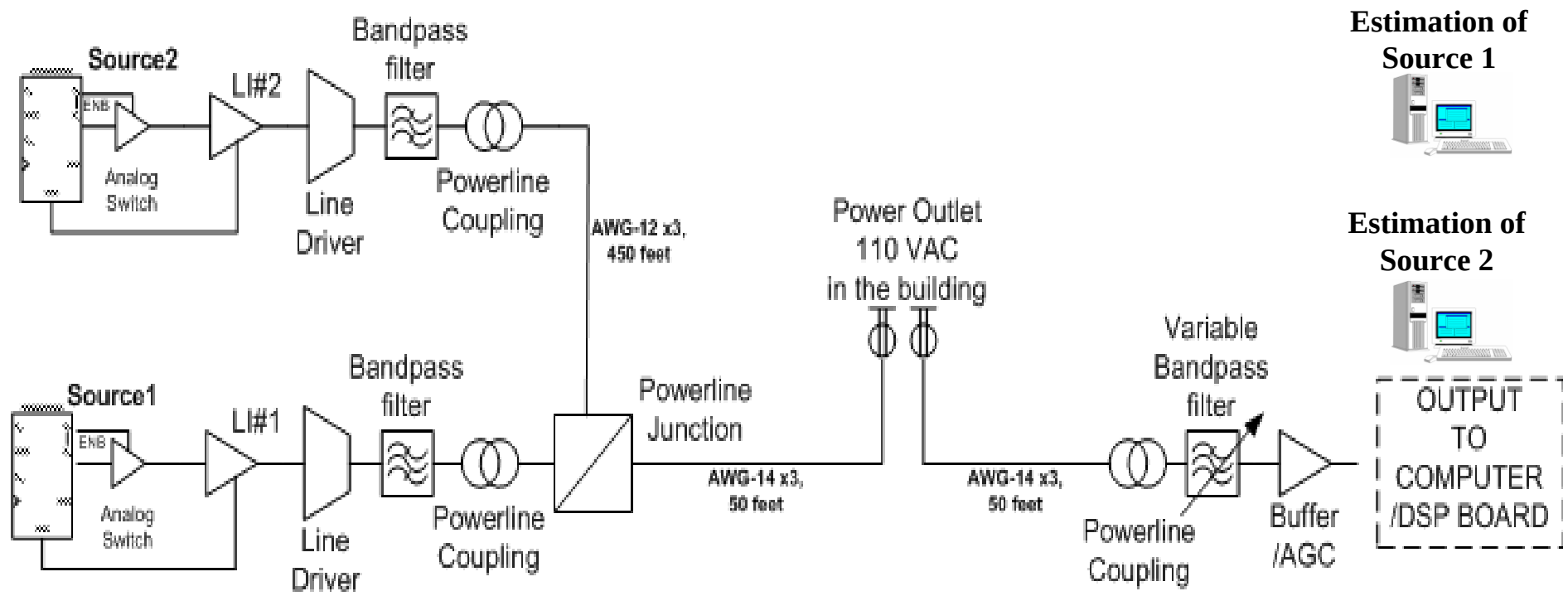


Diagram of the Testing Network



SNR	BER No LI	BER With LI	BER LI & Impulse
5 dB	N/A	4.69e-6	4.71e-6
10 dB	15.25e-3	1.75e-6	1.87e-6
15 dB	9.69e-3	1.88e-7	1.98e-7
20 dB	9.37e-3	1.41e-7	1.41e-7
25 dB	8.99e-3	8.21e-8	8.72e-8

Machines IQ Index

(1)MIQ ⊆ 50%. Supervised category with a lookup table having the extrapolation and interpolation capability up to MIQ ⊆ 50%.

(2) **MIQ beyond 50%.** Human-like sensor learning without supervision is believe to have half normal IQ, scored MIQ beyond 50%. Total combined Swarming Intelligence for self organization M_IQ is assumed to be unsupervised.

(Other than factory robots, futurist robots happen in an open, uncooperative and hazardous environment, e.g. deep ocean, outer space, melt down reactor) with an unforeseeable NL dynamics interwoven with non-stationary complexity).

MIQ=10% is loyal to its human master and its own survivability to differentiate electric power plug having a two-porn's of 110 Volts or three porn's of 220 Volts.2.

1. **MIQ=20%** is able to understanding human conversation in a fixed semantic network for a closed domain dialogue).
3. **MIQ=30%** is able to read facial expression and voice tone for e-IQ to understanding the emotion need of human being.
4. **MIQ=40%** is able to command and control a small team of other robots.
5. **MIQ=50%** is able to "explore the tolerance of imprecision," e.g. using fuzzy logic to negotiate a single precision path finding in an open save terrain.

All men are created equal;but machines are not.

Each device is designed differently to do specific functionality, a fuzzy membership function, e.g.
F ={JD(job description),M-M interface,
DC(duty cycle), Reliability, Alternative Power, integration with other device,…}
with a mean value that evolves in models or time to serve us.

Take F-ensemble Average Person Doing (APD):

$\langle APD \rangle_F$ = Unity, what's half?

then M_IQ = a monotonic scale of $\langle APD \rangle_F$

Could we agree M_IQ <50% supervised or rule-based?

Information Degree of Freedom

- Basic info-assurance question is how can one be sure about the trustworthiness of any info. Sirovich (PNAS 2003) analyzed the past 8 years of 9 US Supreme Court Judges, whose complete record of votes +1, -1, abstained 0 over 640 cases of which 448 are admitted.
- 9 judges in 9 D: [Breyer, Ginsburg, Kennedy, O'Connor, Rehnquist, Scalia, Souter, Stevens, Thomas] = [-1, -1, 1, 1, 1, 1, -1, -1, 1] for 2000 US President election
- PCA shows unprejudiced degree of freedom is 4.68 ideal judges.
- Two party political system supports 9 judges which might be only camps. In reality it seems to be 4 & half parties.

Software might also need a degree of M_IQ for de-conflicting incompatible programs or OS subsystem upgrade

Degree of difficulty:

1. Massive Parallel Processing
2. Applications domain integration
3. Self-diagnosis: Bug discovery program self-repair
4. Change cortex: Operation subsystems upgrades

- Search Engine Digital Divide: Next Gen Internets; 3rd Gen Cellular Phones
- Omnipresence—all the time, everywhere
- Launch by 2008 Olympic Beijing, 2010 Worlds Fair Shanghai (IP address V6, 128 bits, vs. Cell phone IP address)
- Broad Band requires new array of Transceivers
- new RF towers, similar to HDTV
- Intelligent Interface, user-friendly voice Input
- Innate Natural Intelligence, Voice Video I/O, Robotic Team
- Office Mates, Smart Search Knowledge Engine

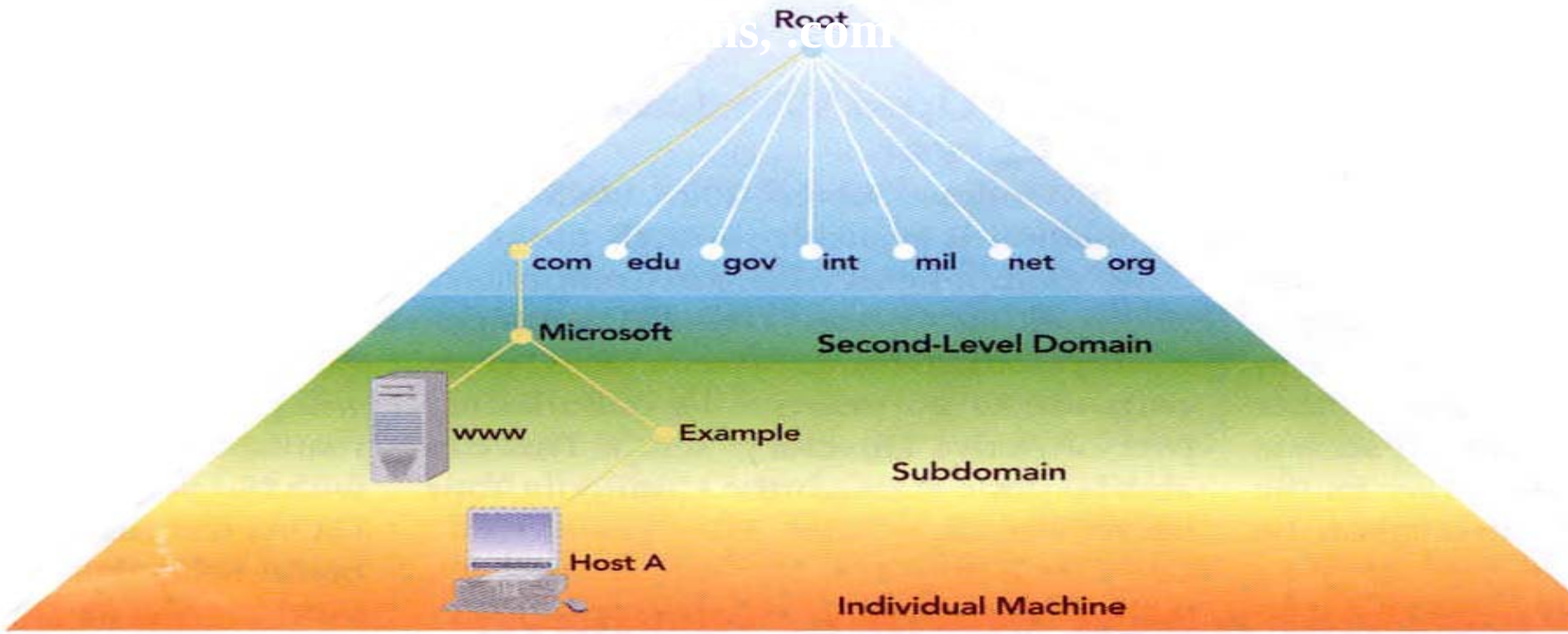
Given self-similar PSD=1/k due to factor 4 for addresses,

127.0.1.25= www.techmagazine.com

IPv4 adopted another factor 4: 32 bits=datagram;

IPv6 adopts another factor 4: 128bits=4 d-grams.

Proof: FT of self-similar PSD FT{1/k} = unit step correlation of all scale (cf. see details in Appendix)



total IPv6 addresses =$3.4X10^{38}$).

Human Civilization Overview
Info Acquisition Perspective, Smart 6W cf. SPIE ICA etc. 2006

- Historically, the Greeks built theaters everywhere they went, spread art; the Romans built roads everywhere they conquered, spread commerce.
- Much beyond ***(1) roads***, the Romans rebuilt the Greek metropolises with (2) ***water supply pipes*** and (3) ***waste sewage lines.***
- Over a thousand years, growing cities prompted modern western industrialization by means of (4) ***steam-engine trains and railroads***, which accelerated (5) ***ship-line and airline*** commerce that shrink the scale of the earth.
- Recently, info tech launched knowledge economics with the advent of (6) ***Internet***, making last-mile-mobile-broad-band-communications the major challenge of this Century.
- We think the always-on-every-where legacy (7) ***electrical power-line*** could play important role? surveillance of environmental condition need.
- Next Gen Internet (IPv8) based on ***decimal telephone address*** as individual web address could provide a unique and abundant ID for global partnership. Besides, we must solve robust ID ={who,where,when}, one-hook deep web mining for authenticity, pair-wise privacy, and reliability of web knowledge.

High dimensional data representation

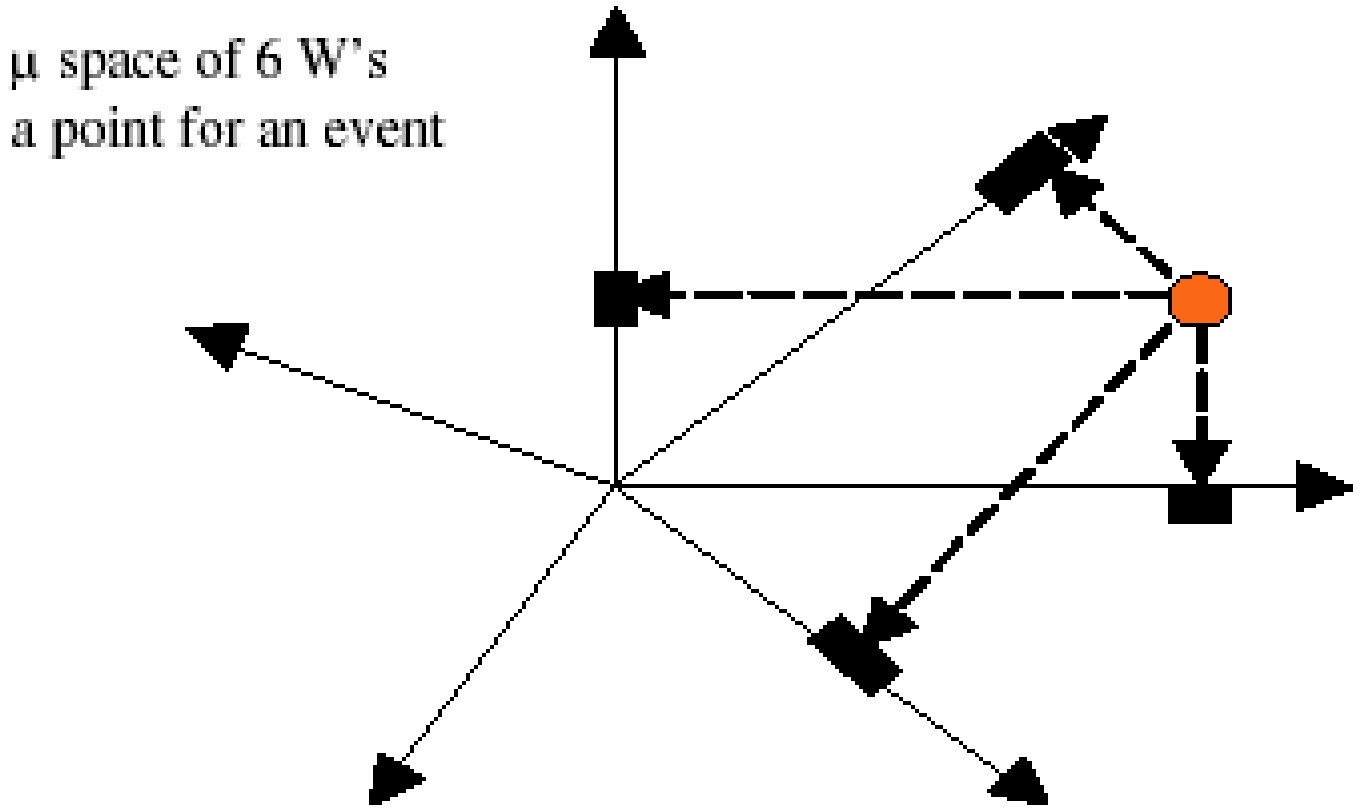


Fig. 1. Data acquisition layer of 6-D μ-space. A point is an event or story in the 6W's "who, when, where, what, how, and why" μ-space; a rough fuzzy set associates a range of projection value indicated by thick line segment.

From 6W data fusion to feature extraction

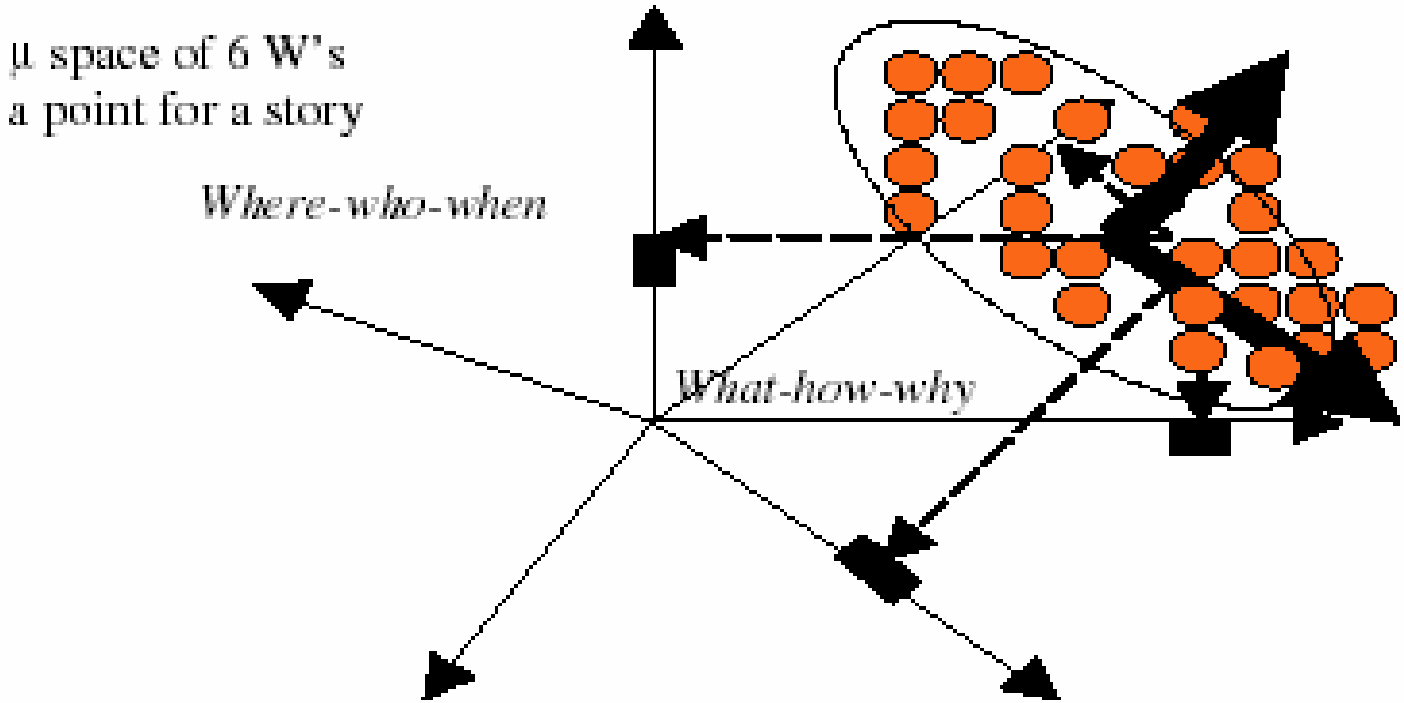


Fig. 2. N newspapers of a daily story yield N dots on 6-D μ-space, where the invariant feature subspace is derived by PCA or ICA as the concatenated space-time event (where-who-when) and cause-effect (what-how-why).

From invariant feature 6N+time to knowledge

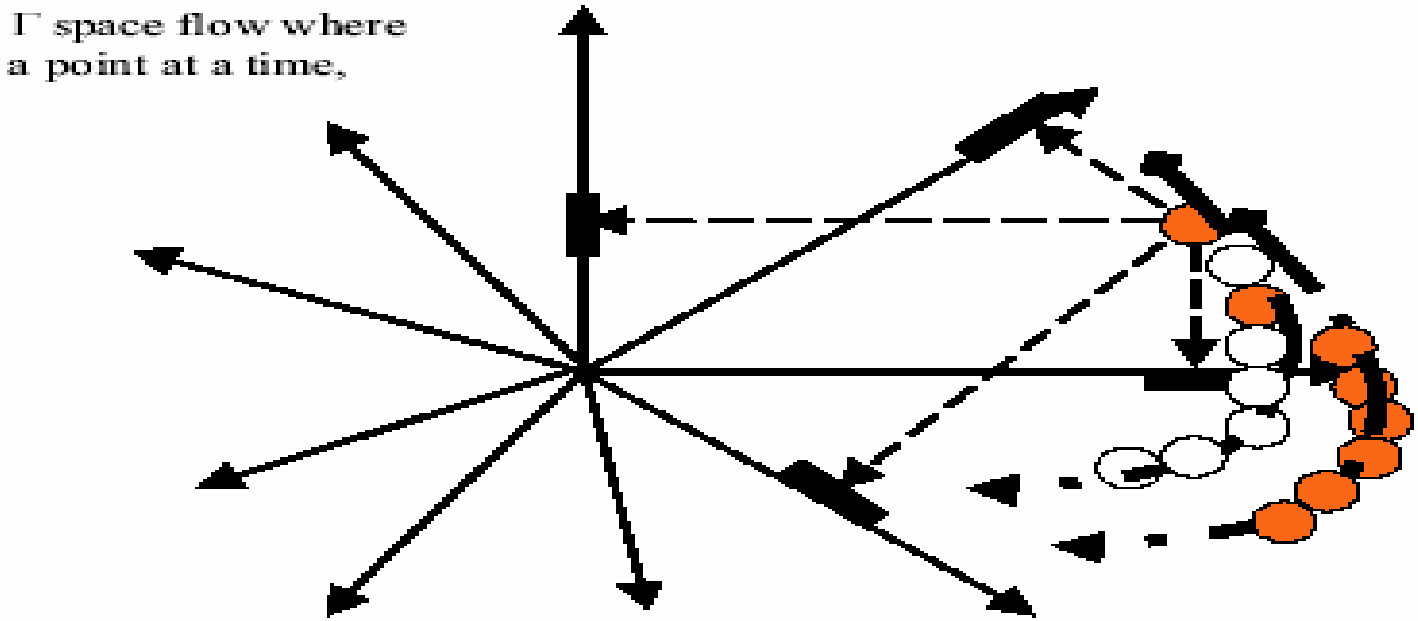


Fig. 3. A time-invariant feature space becoming known as the knowledge space. In this example, "U.S. President John F. Kennedy was assassinated at Dallas, Texas on November 22, 1963" two major-track bifurcations might occur in time in the subspace of 6ND Γ-space of N reports over years those major and minor feature axes in the 6D μ-space. The knowledge discovery can be "a track of conspiracy theory and a track of loner lunatic theory," and one becomes dominating over the other in time as the evidence is presented.

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