THE OPEN INFORMATION OPPORTUNITY FOR GREATER U.S. INFORMATION POWER

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THE OPEN INFORMATION OPPORTUNITY FOR GREATER U.S. INFORMATION POWER:

SUGGESTING A GLOBAL, STRATIFIED INFORMATION STRATEGY RELATED TO
DEFENSE, COMMERCE, POLITICS AND POPULAR EDUCATION —

Introduction -- A Domestic Confidence Building Dream with U.S. Power
Benefits (Chickens, Pots, Promises, and Power).

The bases of U.S. economic, military, political, and
psychological powers can be classified as natural and human. With
some attention, the natural elements are long-term—geography and
natural resources. With equal prudence, the human elements—strong
backs and strong minds—can be nurtured each generation. Given our
superpower reserves, in spite of sensational and pessimistic headlines
this election year, the United States with its particularly sturdy
Constitutional democratic government, will survive.

Will the United States have the power to lead toward a new world
order that improves the state of humankind and provides stability
vital for international trade to the benefit of all nations? Will
U.S. aggregate power grow sufficiently to take the lead? Will the
United States be well prepared for a world where trans-national flow
of information and wealth will permeate the sovereign borders of our
nation and its states to the point that conventional business
protectionism and import and export controls will no longer be
feasible?

Historically, the United States has always risen to the occasion
once it has been decided to apply the full spectrum of its natural and
human resources. If we prudently look beyond election year headlines,
we might rationally observe that the United States has tremendous
resources and it is not likely to succumb to its recent deficit
spending habits overnight. The solution will not resemble those of
the past—a monolithic, resolute nation standing strong on isolated geography—but consensus, agreeable, coalition whose information lifeblood is shared internationally.

U.S. citizens are likely to have increasing direct influence on both Congress and the Presidency through polling, then popularly initiated straw polls, and finally to outstrip Congressional power by unofficial electronic, direct plebiscite voting to their Congressman's office. Of necessity, U.S. citizens will need to be well-educated and informed for the responsibility of guiding our nation—these changes will happen whether they are prepared for the responsibility or not.

The President will need to be highly informed and stake out a leadership stance. The Congress and Presidency will make less policy and spend most of their time portraying and executing the desired policy of the people. Earthshaking change, but within the ability of the United States to thrive if its citizens are prepared. Focusing on the immediate future, there remains hope and it is worth looking for a means of recovery.

Needed a Believable Plan—Visceral, But Steadfast.

It is not likely that the U.S. economy can regain its former growth rate, and return us to prosperity, until we hit upon a believable plan—a plan so believable and tangible to the person on the street that it has a good feeling at the gut level. The nation looks toward a contagious means to restore confidence. For President Kennedy, the Apollo program taking a "giant step for mankind." had the requisite magic. Space exploration is not the sole answer today. It is not that space is no longer a magical place, a high ground with a grand view of planet earth and visions of the primordial universe. Space is an accepted effort recognized in the budget and important to
stimulating a portion of the U.S. economy without a doubt. But U.S.
leadership must restore both foreign and domestic confidence by a
means that is as identifiable as the starry night sky’s canopy and the
dawn’s blazing sun are to every U.S. citizen. It must be a mental
tonic as magical and rejuvenating as the thoughts of man soaring to
set foot on the moon just after the doomsday shock and specter of the
Cuban missile crisis. It must be a plan that suits the 1990s and can
provide concrete results within this decade. Cold War and atomic
annihilation have been replaced by shifting borders and stagnating
economies. But psychological burden and job endangering economic
impact are no less discouraging.

Where can we find such a tonic? Presently, the U.S. leadership
is pursuing corrections in public education, boosting high technology
research and development coffers for biotechnology and advanced
computing, and continuing to probe for understanding of our earthly
environment with satellites orbiting in space. Established U.S.
industry is struggling to bring new and better quality products to the
marketplace and to gain entry into key foreign markets.
Entrepreneurs, seen as potential knights in shining armor, are trying
to protect the virtues of U.S. high technology while attempting to
avoid catastrophic surprise by companies and products that they have
never heard of before. Our moral fiber cries for a means to
ameliorate the effects of a demographic patchwork of immigrants and
impoverished Americans that are suffering and are concentrating on
survival in slums with schools where children are at risk of drugs and
gun shots.

Simultaneously, U.S. companies are turning elements of beach
sand into the lifeblood of a multi-billion dollar personal computer
industry. Major corporations are taking strides into the post-Cold War world by becoming integral members of joint telephone, fiberoptics, and information services ventures in republics of the former USSR almost as soon as the U.S. government recognized the new republics. Most Americans know of personal computers, telephones, and televisions. There is a common theme in these tragedies and miracles—information.

Knowledgeable people are prospering on devices for transmitting, processing, and reproducing information. Poor people are unable to lift themselves from poverty and their children are likely to follow in their footsteps for lack of knowledge. Attempts to stimulate the economy, to kick start it, by developing biotechnology, computer knowledge, and inexpensive space systems are vital focused portions of such a kick start effort, but more is needed. Do the passengers know where we plan to go when the economy does turn over?

We need one last personal and corporate example, Bill Gates. Gates is a 36-year old that started writing software to manipulate the internal actions of microprocessors in his youth. He is the creator of MS-DOS, the basic operating system software that runs 80 million personal computers. His company, Microsoft, is the producer of Windows that is being run on 9 million computers. He is a visionary that plans to add Windows New Technology this year. Windows NT is intended to begin practical internetting of all computers from palmtop to laptop to desktop in networks of hundreds. These almost living interpersonal networks will connect to vast libraries of data called on-line services available by telephone lines. Furthermore, networks will connect to other networks anywhere in the world.

Bill Gates is the richest man in the United States and his Microsoft Corporation is valued higher than General Motors (Gates' personal stake is valued at $7 billion and Microsoft is $22 billion). Add one last ingredient—a common awareness of televisions, telephones, and computers. What do we have? Ubiquitous valuable information, inventive computer and telecommunications makers producing a global network, and a suburbia-to-incredible riches story with a modern hero. Plus the prospect that the personal computer, telephones, and television could spark these ingredients into a program transfusing information, education, and wealth that stimulates the confidence and economy of the United States, while building global rapport. Exit containment—enter rapport.

A Tonic Blended for Domestic and Foreign Policy.

Information power could be the tonic to cure our economic, education, and poverty malaise. How? National assistance, like the TVA Rural Electrification Act, could drive the price and user friendliness of personal computers and software to commodity levels and install them in every U.S. school. This could become a national confidence building program that provides immediate jobs and business stimulus, moves us from smokestack to silicon-and-information industry, and provides vital education and heroes to every grade school American as an investment in sustaining U.S. superpower.

Let us apply the brain power from a downsizing Department of Defense (DoD) and Department of Energy (DoE). One possibility is to focus new efforts through the Department of Commerce (DoC) at the National Institute of Standards and Technology by creating a Critical Information Division (NIST CID) assisted by Defense Advanced Research Projects Agency (DARPA) computing consortia. A nationally guided,
commercially executed program has the potential to use information
domestically as well as internationally and generate millions of "points of light." The U.S. Congress is interested in reorganizing the U.S. intelligence community under a new Director of National Intelligence, perhaps there sweeping revision should create a Director of National Information---consolidating closed-source information under the Defense Intelligence Agency in DoD, moving the remaining Central Intelligence Agency functions and special legislative authorities of the National Security Acts of 1947 and 1949 into DIA, and consolidating open-source information under DoC Critical Information Division (DoC CID). If the turmoil of broad bureaucratic change is inevitable, let us increase the scope to prepare for tomorrow rather than patching up mistakes from yesterday. The DoC CID would answer to the Secretary of Commerce and DIA would still be under the Secretary of Defense, but the new Director of National Information would advocate, coordinate, and ensure the U.S. Government maximum use of open and closed source information and analyses.

For over 45 years, the United States has prospered in the industry of containing Communism, perhaps for the next half-century, the United States can more evenly distribute growing prosperity by an active domestic and foreign policy of information redistribution---rapport ("info rap?"). The former republics of the USSR need wealth and they have information that had been denied to the world and their own people. We could start with the following:
1. Offer youth the opportunity to produce the next Ross Perot (EDS and Perot Systems), Bill Gates (Microsoft), Steven Jobs (Apple and Next computers), or immigrant Philippe Kahn (Borland Software),

2. Level basic information globally to ensure mutual economic growth and greater political trust, and

3. Obtain years of missing cultural information and intelligence ground truth to foster better relations with the emerging Commonwealth of Independent States.


I have discussed potential benefits of decreasing personal computer costs through technology and standards and putting computers in every classroom, while giving U.S. computer industry a greater competitive edge. This would also provide the means to move and process vast quantities of information for broadly based benefits. Where do we get the information, the working capital, of the future?

Much information is or will be in the public domain, but the U.S. government will have to perform a vital role in collecting and making information available. The Government will need to promote technical standards and standards of conduct, as well as protection against privacy rights violations.

I would like to focus on the U.S. government involvement in the international transactions of open source information for the remainder of this paper. I will begin with discussions about information power and flow. Then discuss reasons global information is not uniformly distributed and how monitoring and redirecting
information flow could be fruitful. Finally, I will propose a nationally developed open source information "sea."

Implementation of the suggestion to develop a national-level, open-source information sea could telephonically provide information needed by schools equipped with desktop computers. The combination of computers and information would give all school children a chance to step into a more promising world and become the adults that will maintain U.S. information power.

Focus on information power.

U.S. trade once used barter--slow--turned to currency--faster--and is now irreversibly reliant on computer bits--nearly as fast as the speed of light. U.S. superpower is completely dependent on information moving at computer and telecommunications velocities--information momentum that provides national impact. It follows that information power is the product of information mass and U.S. capability to accelerate or redirect information flows for the time needed to achieve national interests. We survived the beginning of the information explosion and are learning to channel information torrents into applications.

At the federal level, we have unwittingly used information power piecemeal, but without recognition of the whole fabric. Recognition, initial definitions--metaphors borrowed from science and economics--and then actions and policy should be forthcoming to gain more of the tremendous leverage available in the global information commodity. We must also recognize that reliance on information power creates vulnerabilities that should not be overlooked. For example, there are more than one-thousand personal computer viruses in today's environment. Yet there are no national standards or guidelines for
banks, hospitals, universities, and emergency services to immunize

Information Lines of Communication (ILOCs) Will Be To 2000 What Sea
Lines of Communication (SLOCs) Were To 1900.

Long-term national power may be determined by geography, natural
resources, and human character, but transient power is a function of
effective national information use. As Mackinder's "heartland" and
Mahan's maritime strategy for extending and protecting SLOCs excited
and guided the U.S. at the last turn of the century, information
centers and information lines of communication (ILOCs) will greatly
influence U.S. national power at this turn of the century. Is anyone
preparing a strategic atlas of the centers and lines of information to
sustain the U.S. as a superpower--superinformed and decisive? Will
the United States have a Presidential administration that exudes
confidence from being highly informed? The information ocean is open
to all that can muster the means to exploit its contents. Not a zero
sum game, many can benefit by U.S. leadership.

The 1990s offer the opportunity to draw on unprecedented open
source information from a rising information ocean while continuing
use of closed source information (intelligence from sensitive sources
and methods). Information can be poured into separate open and closed
information seas, respectively, for domestic and intelligence
analytical use on demand. These seas should be kept pure so open-
source information rapidly can be offered to U.S. commerce and
education without fear of compromising sources and methods. U.S.
defense can have more timely tailored intelligence and access to a
great open sea of supporting information, e.g., maps and industrial

and communications infrastructure descriptions vital to successful modern "hyperwar" as evidenced in the Persian Gulf War. This win-win situation is made possible by the opening of Cold War denied areas and accompanying political turbulence, vast new potential commercial markets, and computers that can process millions of megabits of information each second. Finally, some U.S. information-handling restructuring to more greatly involve commercial benefactors may be advisable. Let us step through the "looking glass" to take a new look at the utility of harnessing information for greater U.S. economic, military, political, and psychological power as the melted Cold War raises the world's information ocean level.

Memories and Speech.

American speech is spotted with literature acknowledging the power of information—knowledge is power, the pen is mightier than the sword, and one picture is worth a thousand words. The Security Exchange Commission prosecutes to deter the premature sharing of "inside" information. The National Photographic Interpretation Center keeps 160 trillion bytes of imagery and related data handy to assess changes in the world. In 1985, INTERNET world-wide networking of computers consisted of more than 5,000 networks in 33 countries and 500,000 connected computers directly attended to by more than 3 million people—recall this was before personal computers became so common as to potentially add millions more devotees. Communication satellites (Comsats), crowded less than two degrees from one another 19,000 nautical miles above the earth, compete to serve a world where it no longer is uncommon for hundreds of millions of people to

"Applying the INTERNET: Corporate, Research, Educational, Governmental, and Other Real World Uses." Byte. February, 1992, 111-118.
1 simultaneously watch the Olympic games. Ukraine has formed a joint
2 ownership venture with AT&T (39%) and PTT Telecom Netherlands BV (10%) to modernize and extend its telecommunications system in the next 15 years.5 And USA Today's Special Projects Unit gathers and analyzes government data daily for current stories. The newspaper staff has coined their work as "database journalism."6 Imagine the network to support CNN! Where change is integral to business, even the most agile entrepreneurs fear surprise by companies that they have never heard of introducing competitive products and taking market share.7

10 Corporations are building business information offices to counter surprise by competitive products. The rapid accumulation, processing, and distribution of data is part of life in developed nations.

13 Information Oceans, Open and Closed Seas, and Pools.

14 For the skeletal framework of this strawman, terminology is needed for you to visualize the distinctive components. I have chosen to refer to the initial quantity of sounds, bits, radiation, and color hues and intensities as data. Data filtered for higher level correlations—sentences, tables, images, statistics, stochastic relations, and so on to suit users—is information. Finally, information absorbed and capable of human invention or application is knowledge. Intuitively, refined data becomes information and refined information, consolidated by persons to solve a problem, is knowledge.

23 There is a growing quantity of data, information, and knowledge within, upon, and above the earth without limit that I simply call an information ocean. It is continually fed by tributaries replenished

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by physical processes in our universe and by persons and machines
drawing from the information ocean and changing, rearranging,
processing, and adding value to the ocean's data, information, and
knowledge. For example, if I draw all phone numbers from the ocean
and correlate the numbers with an alphabetical listing of telephone
subscribers, I have created a telephone book. The book has greater
value than the uncorrelated numbers and names. The effort has added
order to the names and numbers and made information of greater value
to telephone users. If I must call a plumber to fix a drain in my
home, a list of plumber's phone numbers has even greater value. The
process of memorizing a plumber's number and placing a call for
repairs is an application of knowledge. I believe that you will agree
that when a leak is flooding your home's basement that having the
knowledge to immediately place a call for repairs is more valuable
than knowing where the phone book is--it might be submerged in your
basement study. The phone book contains essential elements of
information (EEIs) for home maintenance. But more valuable is the
knowledge to accomplish the process of calling a plumber when needed.
Intuitively, since work has to be done to cultivate knowledge
from information and form information from data, knowledge is higher
in value and more sought after than information or data.

Carrying our framework somewhat further toward a model,
knowledge together with tools and infrastructure is technology.
Knowledge with appropriate financial tools and a market could beget
commerce. Likewise, selected knowledge, tools, and infrastructure
(when applied to the defense, commerce, politics, or education
"market") can be useful to domestic or international problem solving.
Pressing onward with the information ocean analogy, after processing,
data, information, or knowledge collected from the ocean can be shared by returning it to the ocean by some communication tributary or diverted, at least temporarily, to an open or closed information sea where it can be exploited by the nation that collected, added value, and stored this information. Therefore with carefully selected rules, collecting and sorting data, information, or knowledge from the ocean, can lead to two large seas. For simplicity, I name this first sea an open information sea. The second sea, called the closed information sea, is filled with data, information, and knowledge collected, perhaps decrypted, and sorted from sensitive sources and methods. This second sea is filled with information that is often referred to as intelligence. But for this paper, I also name it the closed information sea.

The open information sea derived from lawfully obtained open source information could be used in commerce, education, politics, and defense with impunity to benefit the United States by domestic application or to benefit or influence foreign nations without harm to U.S. intelligence sources and methods. The closed information sea is not customarily, readily available to U.S. commerce and education. Portions of the U.S. DoD, DoE, and DoS (and lesser parts of several other departments) have workable access to the closed information sea. Time and analysis permitting, under tightly controlled conditions, U.S. and allied military planners can draw vital information from the closed sea to acquire weapons systems, establish needed C\(^2\)I links, and support effective use of military power. The U.S. defense industry also develops knowledge and technology from the contents of the closed sea. Information from the open information sea and selected information drawn from the closed information sea could form
commercial and defense information pools tailored to readily become applied knowledge benefiting the United States.
FIGURE ONE
DATA, INFORMATION, AND KNOWLEDGE DEFINED AS OCEANS, SEAS, AND POOLS SATISFYING ESSENTIAL ELEMENTS OF INFORMATION
Bottom Up or Straight from the Top?

During Cold War years, the U.S. intelligence community necessarily adapted to and grew accustomed to building its knowledge base--closed information pool--bottom up from data and information with only an occasional opportunity to access high-value personal knowledge. All data and information painstakingly had to be validated by corroborative sources. Access to denied area ground truth and leadership intentions were rare. The inputs were mostly from the closed sea. Now, following the breakup of the former USSR, but before the former USSR republics opt stridently to try to deny access, higher value ground truth and current open sea information is available. Furthermore, much must remain open to establish commerce with nations such as the United States. The United States can gain much by increasingly drawing from this greatly upwelling post-Cold War information ocean. The highest value information, such as that possessed by immigrating scientists, is becoming readily accessible. For example, Dr. Roald Sagdeev, a former Soviet nuclear physicist and space operator, is now a University of Maryland Distinguished Professor.³ Cold War ground truth and intent could be openly available, awash in the information ocean. More exciting is the prospect that evolving telecommunications and computer capabilities may make us capable of filling and sifting through the open information sea so rapidly and capably as to discern evolving future economic, political, military, or non-traditional threats to vital interests in time to forewarn the United States. Processing systems can be primed and awaiting appropriate requests by planners for EEIs to draw out needed information to withstand economic or military threats. Greater

³Space conference brochure listing Sagdeev as key note speaker.
reliance on the swelling open information sea will permit direct use
of information by U.S. industry to increase U.S. commercial
competitiveness.

It is still true that open sea information must be validated by
corroboraton with closed sea information. Therefore the invaluable
intelligence capability of the United States, painstakingly built
during the Cold War, essentially must remain intact as insurance
against deception or wholesale misinterpretation. But it is
conceivable that portions could be scaled back if one should take
fullest advantage of the open information sea which contains top level
knowledge at less expense and risk of misconstruction. It would be
refreshing to capture the view from the top without always having to
build a look out to stand on to see more clearly.

Information Power As An Instrument of National Power

There is nothing especially new about this explosion of
information nor the telecommunications that moves portions of it with
the speed of light. But the opening of much of the world's previously
denied area, former Soviet Union closed society; the use of computer
bits rather than dollars as a unit of accounting in world trade; and
major environmental data gathering initiatives like NASA's Mission to
Planet Earth are examples that indicate that there is a geometrically
expanding information ocean growing far faster than U.S. industry or
defense can exploit it. This ocean contains accounts of world trade,
data waiting to be refined and value added for resale, and much of the
worlds formerly closely held secrets, particularly those for defense
technology. Mining and refining this ocean fastest taps the mother
lode to regain U.S. commercial ascendancy and maintain defense
intelligence superiority. The ocean is not new, recognizing its
relation to rate and level of national development and exploiting its
relation to national power and planning to best incorporate
information power in future U.S. strategy--along with the classical
geo-strategic elements of defense, economic, and military power--is
new.

Dr. Edwin H. Land, inventor of Polaroid instant photography
said, "Discoveries are made by some individual who has freed himself
from a way of thinking that is held by friends and associates who may
be more intelligent, better educated, [and] better disciplined, but
who have not mastered the art of a fresh, clean look at the old, old,
knowledge." I submit that it is time to take a fresh look at the
value of information that is accumulating. Time to think anew how the
United States uses the foundation built by Morse, Babbage, Bell,
Edison, Marconi, De Forest, Sarnoff, Shannon, and Von Neumann.

Information Deus Ex Machina.

How can the United States exploit this geometrically expanding
information ocean? Fortunately telecommunications, massively
parallel and optical computers, and new capabilities, like object-
oriented databases and neural computer programming, are likely to make
practical sorting the information flowing through major tributaries
and drawing from the information ocean to put copies of relevant
information into the open and closed seas for future use. Neural
programming could recognize patterns sought by standing EEI
requirements for defense, commerce, politics, and education. Neural
network programs could review past intelligence and economic successes
and failures for patterns that suggest new EEIs--a self-teaching
indications and warning capability for defense and commerce!
Let us look at an example. If we were to persuade every human on earth to speak their mind simultaneously, the result would be about 120 words per minute, two words of five letters, i.e., about 80 bits per second, times six "giga-persons", or $4.8 \times 10^{11}$ bits per second of data—about 150 *Encyclopedias Britannica* per second. Collectively communications satellites carry more than $4.8 \times 10^{11}$ bits of data each second! Routine communications relay of information exceeds the entire potential collective expression of mankind at any moment!

Could computers process this information flow for useful information in real-time. That is, are computers available, or soon to be available, that could process all the speech of mankind as the words are spoken? All the publications and broadcasts as they occur? Could current technology search this hypothetical production of information for EEIs in real-time? Can computers and telecommunications deliver such rates?

The Defense Advanced Research Project Agency (DARPA) leads the Concurrent Supercomputing Consortium. It has provided a 128-node (Intel Corp. i860 processor) IPSC/860 computer to the National Institute of Health which performs $7.6 \times 10^9$ ($10^9$ equals one billion) instructions per second to develop advanced techniques for analyzing protein and virus structures. The DARPA-sponsored Touchstone program Delta prototype performed 11.9 billion instructions per second last November. By developing a newer Intel Corp. microprocessor chip, a commercial machine, the Paragon XP/S, will offer five-billion-instruction-per-second supercomputing by 1993. The Paragon will cost two-million dollars—one-tenth to one-hundredth the cost per instruction per second of office personal computers and an order of

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magnitude cheaper than infamous Cray commercial computers of today.

Such newer computers supporting the aerospace, chemical, electronics, petroleum, and pharmaceutical industries could increase the U.S. GNP by $500 billion in the 1990s. Affordable computers exceed $4.8 \times 10^{11}$ bits per second and telecommunications is about to pass this 480 billion bits per second rate. Current AT&T fiberoptic T-3 trunks carry 45 million bits per second between major U.S. metropolitan areas. AT&T Bell Laboratories have demonstrated 32 billion bits per second and experiments have produced 100 billion bits per second rates.

If one fed each of the Delta's more than 500 processors one word at a time taken from the incoming stream of $4.8 \times 10^{11}$ bits per second, that is two words per second times six billion persons or $1.2 \times 10^7$ words per second, it would take $1.2 \times 10^7$ divided by 500 to look for a single key word given to all 500 processors simultaneously. Doing the arithmetic, $1.2 \times 10^7$ divided by $5 \times 10^2$ equals 24,000 cycles. For simple key word search, it would take one-hundred times as long for one-hundred different key words, that is, it would take 2.4 million cycles. Neglecting computational overhead, the Delta performs more than ten-billion instructions per second using its 500 processors, so each performs two-million cycles per second. If the incoming information is in plain text in this overly simplistic example, the current Delta could sort through the entire expression of humankind for eighty key words without falling behind! The Delta is not even optimized for this problem.

An eighty key word search is not sufficient for substantive searches, but one most likely would distribute a number of machines--

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remember a $2 million dollar version will soon be available—at
convenient locations where portions of open broadcast and publication
data would be available. The findings of decentralized, or
centralized multiple machine searches, would be fed to successively
more complex searches by neural network programmed machines to look
for associations that could provide indications or intent of impending
political, economic, or military clashes or opportunities in
inventions or markets and more.

Neural nets could perform any algorithm provided by example.
Custom neural programmed chips are commercially available now as are
printed circuit cards for personal computer use that make over three-
million connections per second per card. A Delta machine hybrid with
1860 conventional supercomputer cards and customized, reprogrammable-
by-sample cards would be significantly faster and able to look for
correlations that parallel history.

Historical descriptions of conditions before the Yom Kippur and
Arab-Israeli War could be reviewed by neural programs to form EEIs and
search algorithms to best monitor for similar cases of impending
surprise attacks throughout the world. The National Intelligence
Officer for Warning could use this as a tool to expand his staffs
ability to read all the "mail." Analysts could productively spend
more time synthesizing "big picture" looks at trends that threaten
U.S. interests. They could build compelling cases to forewarn in-
country U.S. ambassadors through the State Department watch. An
ambassador could be forewarned before being called to unexpected
meetings with heads of state, such as Saddam Hussein seeking to
reinforce his perception that the United States would not intervene in

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11 About $2,000 per card at present production rates.
12 Based on Intel Corp. and California Scientific Software brochures.
the Iraqi invasion of Kuwait. The 1990s will bring personal
communication devices ("pocket communicators!") that ambassadors could
carry for immediate communications and personal safety.

The Delta is designed to meet the requirements of designing
pharmaceuticals, understanding biological structures, and control of
vehicle signatures. Another order of magnitude in speed will enable
its successors to tackle the extremes of climate modeling; ocean
circulation; semiconductor and superconductor modeling; fluid,
aerodynamics, combustion engine modeling, and human genome data and
modeling. These problems are similar in complexity to fully sorting
essentially the full output of humankind's information in real-time
into selectively EEI-filtered information seas by complex sorting
rules. Collectively all U.S. intelligence analysts working together
could not approach this capability, but analysts can benefit from such
a machine's support.

These ultrafast machines use current integrated circuit
technology—that is they "rack and stack" Intelligence Corporation
processors in a massively parallel computing configuration to divide
the incoming information into multiple, parallel paths that are
operated on simultaneously. Hardware will no longer be the limiting
factor and detailed questions need not be formulated and researched
long before national interests determine the specific area to
research. Tongue-in-cheek, but with some serious applications in
mind, I noticed during the Persian Gulf War, one could have perhaps
used CNN input to initiate neural programs to create background EEIs.
These EEIs and algorithms would in turn perform timely research to
confirm or deny the accuracy of CNN reporting, and answer many
questions that CNN generated within the federal government!
Let us take a knew look at world resources. Facts about space, earth, seas, atmosphere, minerals, people, population, society, business, military art and hardware, countries, nationalities, and so on are data available for collection, and much has already been collected. Recall that information is produced when data is processed, for example, filtered, correlated, and analyzed to extract and retain a product that can be exploited. Furthermore, knowledge is a collection of information that is stored within a human mind equipped with the innate intelligence, education, and communication skills to practice exploitation. The addition of readily available computers and telecommunications acts as a catalyst boosting the mental productivity for the knowledgeable to more readily collect data and exploit information—to gain knowledge, to invest in technology or simply sell knowledge to attain power. Already one can observe the prospect that knowledgeable people more easily become more knowledgeable and that this is likely to translate into the rich becoming richer the powerful becoming more powerful.

Barter was an initial basis for an economy, but it was slow. Using currency expedited trade. Using computer bits arranged as symbols for currency and goods greatly expedites international, interlingual trade. Similarly, couriers initially were satisfactory in Napoleonic warfare, but only computer-to-computer relay satellite links may be fast enough to prime an effective anti-tactical ballistic missile system. Only high velocity information provided by digital electronic transmissions, not men on horseback, can support the Persian Gulf demonstrated hyperwar with low casualties. Simply, speedy handling and processing adds value and consequently power for information possessors.
The developed nations have information and means to collect, store, process, and transmit it to their benefit. Pre-sorted open and closed information seas have negotiable contents and are usable as national resources. Like gold in Ft. Knox. Lesser developed nations and newly industrialized nations have to retrace invention paths—unacceptably slow—or trade for information possessed by the developed industrial nations to gain technology to continue their national development. Whether the lesser developed nation is on the moral high ground, such as a quest to improve agriculture to feed their growing populations, or pursuing a nuclear arsenal at the expense of billions of dollars for technology (essentially applied information) lesser developed nations must invent or purchase crucial knowledge. Because it takes applied information to extract value from information, the information rich have a nearly unassailable head start, and are likely to get richer, while the information poor remain relatively poor.

Not Necessarily a Zero Sum Game.

Though this need not be a zero sum game as long as natural resources and data are available, it is certainly true that people that are not knowledgeable are at an increasing disadvantage. Likewise tribes, countries, and nationalities lacking knowledge will fall behind since they may lack even the capability to design or acquire telecommunications and computing resources essential to draw from the information ocean around themselves. If they also lack wealth to buy persons with the needed knowledge their lag behind nations like the United States will be monotonically increasing.

It is also true that the dismantling of unions and republics, such as the USSR, is releasing great amounts of data, information, and knowledgeable people. The citizens and member nations will need to
exploit the data, information, and knowledge that they possessed to
care for their people, establish commerce, and provide for defense.
The United States can assist in the exploitation of the former USSR’s
information to the benefit of both the United States and its trading
partners including new markets in the former USSR. This should be
useful to both the United States and the former USSR member nations.
The West can also exploit the quantities of data, information,
and knowledge that previously were bound in NATO countries. If U.S.
defense requirements change in a manner that can be satisfied with
less secrecy than the United States exercised in the Cold War years,
then within the United States there is a body of data, information,
and knowledge that could be exploited for commerce and education as
well as defense.

Dissatisfaction and Wars Still Can Happen.

Marshall McLuhan introduced the concept of a global village.
Arthur C. Clarke, inventor of geosynchronous communication satellites,
foresees the whole world becoming a global village with every resident
having access to two-way voice and picture communications and
databases containing all information known to humankind. In effect,
everyone would be so easily contacted we all would be in the same
village.

It is becoming apparent that the rich and knowledgeable received
a head start that divides the global village. Wealth and knowledge
are not homogeneously distributed within or between countries today.
Networks formed between the knowledgeable form an emerging demographic
strata that is likely to become more distinct with time. Information
will not be dispersed uniformly any more than wealth. Information

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will be aggregated with the knowledgeable—the rich and powerful.

Rather than a uniform global village, we will see information sprawl radiating from commercial and academic centers along telecommunications expressways.

With the potential shift from Cold War emphasis on strategic military power to heated economic power competition, it will not be pleasant to live on the wrong side of the global village tracks without information. This division may be the basis for wars both within a country where it is likely to take sides along racial, ethnic, and poverty lines and similar divisions internationally between developed and lesser developed countries. We are likely to see the unravelling of old world order and the new alliance of countries into groups based on common information lines ("iso-knowledge or iso-technology contours") that are likely to resemble demographic distinctions. We see wealthy third world nations where the wealth is diverted significantly from most people to gain knowledge to develop nuclear weapons as an equalizer. There may be a new phenomenon like colonization, where information "have"s establish relations with dependent information "have nots."


Information lines of communication (ILOCs) are the means for movement of data, information, and knowledge between information centers around the globe. ILOCs subdivide into Data Lines of Information (D-LOIs) and Physical Lines of Information (P-LOIs). Either can further be subdivided into accessible and inaccessible.

Information flowing through centers comes from and is distributed to political, defense, commercial, and popular strata named after their
uses within an information center and the information sprawl into geographic areas outside the information centers.

D-LOCs are formed by operating satellite and radio links, broadcast radio transmissions, fiberoptic trunks, submarine cables, telephone lines, and more. P-LOCs bulk ship information in published documents, knowledgeable people, CD-ROM disks and optical disks, high-technology equipment, and so on. Six CD-ROM disks store the equivalent of an Encyclopedia Britannica and each disk is the same size as popular Compact Disks used by the music industry. High technology equipment is not only useful to nations developing industrially, it is susceptible to reverse engineering for its new possessor to derive some of the proprietary knowledge used in its development. P-LOCs transmitters are aircraft, ships, shirt pockets, shoes, and so on.

Information states send data across sovereignties via telecommunications paths and information flows into and out of strata. Balanced dialogue can be held with business strata. Business normally requires contracts which are inherently two-party exchanges. A monologue is more typical with defense and popular strata. Ask most anyone about departments or ministries of defense and they will note defense personnel tendencies to listen but rarely to provide their national security secrets. The populous consumes vast amounts of information from television and movies to magazines while responding with few letters to the editor or pollsters. They offer their opinion periodically at elections, through political action committees and polls, and union or PTA meetings. It is likely that the populous will provide more direction to their government in the foreseeable future through computer and telecommunications technology. The relation of
Information Strategies and Mechanisms.

With major world powers reliant on computers and telecommunications, business between world powers and penetrating into third world and former major powers will demand computer and telecommunications services and systems. The consumption of systems, services, and data will be a way of life for attaining political and economic power and consequently supporting military power as well. The process of adding value to information as it passes through businesses and nations will become a staple portion of international economics. Participating in this data flow benignly for commercial purposes and tapping it for intelligence value for defense purpose will be vital to nations. Information will become sufficiently valuable that information embargoes will become a tool of international power much like the political, economic, psychological, and military instruments are today. In essence, information power becomes equivalent to economic power for the more advanced nations.

Rather than concentrating on analyzing and taking action on a geographic border basis, I submit it will be useful to examine and influence relative power from a geo-information perspective. Concentrated information flows--concentrated in computer networks through major telecommunications link dialogues or radio and TV broadcast monologues--and between developed nations and between developed and lesser developed, newly industrializing or "information acquiring" nations will be an indicator of relative potential power and a means to influence development and competitiveness or interdependence.

The borders of information centers does not necessarily conform to existing nation borders. Each strata--political, defense, commercial, and popular--has a different magnitude and direction of
information sprawl. Some strata may be totally contained within existing borders others may cross borders. For example, military alliances result in defense strata crossing borders. Furthermore, the alliance could connect the defense strata of the United States center with the defense strata of another center elsewhere on the globe, not adjacent to the United States. The United States may only exchange defense information with this foreign information center and not have popular or commercial strata information exchanges. For the sake of some simplicity, I have included scientific exchanges under the commercial and defense information strata and cultural exchanges under political and popular strata.

New Value: Information Monitor, Supply, or Denial.

The new world's recognized reliance on continuing information flows suggest information power provides new instruments to support political, military, commercial, and psychological power:

1. Monitoring. Monitoring the immigration of knowledge and computer and telecommunications equipment to process data, information, and knowledge provides trend information that may apprise the U.S. of nations attempting high technology efforts like nuclear weapons or supercomputer developments that could confront the U.S. militarily or economically.

Example. Determining that Iraq had sent numerous students to graduate schools for degrees in nuclear sciences and engineering and that Iraq was purchasing ultra-centrifuges in extraordinary quantities could have provided indications of interest in processing spent fuel for plutonium.

2. Banking and Trading. Information banks and aid for humanitarian assistance and developing nations and markets. These
banks could be dynamic (using D-LOCs) and provide for direct "drop shipment" of information (using D-LOCs and P-LOCs).

Example. The United States has to continue subsidizing the operation of the LANDSAT multi-spectral imaging satellite program. Its data has proven invaluable to geologists, civil and military engineers, and to petroleum exploration, but there is little need to repetitively image an area, for example, to find new mineral outcropping. These events occur at a geological pace. Nonetheless LANDSAT has great utility.

Could the United States send a lesser developed country the modest equipment needed to experiment with LANDSAT data and then provide the country with as much LANDSAT data of the country as it requests—not its neighbors or coveted resources like nearby oil fields or military installations. In exchange, the United States might simply stress the need to repay existing debt to U.S. banks.

3. Coercion. Information embargoes on telecommunications LOCs, emigration of knowledgeable people, or control of very specific high technology equipment.

Example. Information embargoes are more likely to focus on deprivation of high-technology efforts such as development of weapons while not depriving the masses of food nor medicine as economic embargoes often do. With refinement and an alliance built on the present Nuclear Non-proliferation Treaty this could slow nuclear proliferation. It might also lead the United States to other suppliers and perhaps permit demarches to slow further export of equipment needed for developing weapons of mass destruction.

4. War. Information wars to deprive a competitor of valuable information.

Example. Information war could be used in the eleventh hour cases
when war appears inevitable over strategic materials such as oil. For example, suppressing communications rates and reliability of information or destroying ILOCs with adjoining nations could destroy confidence in receiving tactical warning of compelling United States or coalition preparations of surprise limited military actions. This is an area where innovation is nearly unlimited, but great wisdom is necessary to consider the ultimate impact. Presidential findings and Congressional notification are likely to be necessary.

More Examples. Information deception certainly has been used in rudimentary ways in support of military power. WWII allies used deception before the Normandy landings to successfully reinforce the Axis view that the landings would be elsewhere and "elsewhen." Also, Patton had the full advantage of proven ULTRA information, but was restrained so as not to tip the Axis to the fact the Allies had broken ULTRA.

This also suggests a defensive role to protect information lines of communication. This role would be similar to the U.S. navy's vis-a-vis sea lines of communications (SLOCs) and the importance it has in modern maritime strategy. Technology for encrypting and to reduce susceptibility to ILOC D-LOC suppression is essential. Security against "hackers" supported by foes will also be essential. This should extend to key financial centers and commercial transportation nodes as well.

Knowing Thine Enemy: Monitoring, Banking, and Coercing.

Monitoring the international flow of information, even benignly, by counting information nodes and products may be a reliable indication of future potential for development. Where are computers, televisions, telephones, communications satellite (Comsat) and
business-operated portable, very small aperture terminals, on-line data services, publishers, newspapers, stock exchanges, and so on.

After Saddam Hussein fell victim to the "Hail Mary" end run, future competitors will place greater emphasis on exploitation of open and closed source intelligence for greater military power and logically for greater economic power also when competing with the United States.

Tracing the acquisition of computer equipment and telecommunications gear is tantamount to understanding upcoming power bases in the Third world. Certain equipment is more likely for use in each information strata whether political, defense, commercial, or popular.

Another potential strategy consisting of the tandem use of information bank incentives and coercive embargoes or publicity could use promises and threats to achieve U.S. national interests. Per Schelling Arms and Influence, China, Britain, and France may have built nuclear weapons for political rather than military reasons. Much of the purpose of nuclear weapons development in these nations could have been served by any extreme technology demonstration, like the French ARIANE space commercial launch capability. These are information intensive projects for power, prestige, or substantive development. Could we abate nations seeking nuclear weapons for political reasons by revealing privately to the proliferating country that we know of their nuclear weapon program or publicly exposing their programs? Could we apply coercion or promise information causing or making practical the substitution of other information intensive programs

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that need not have mass destruction as a potential outcome if their weapons program is intended to bolster political influence?

Whether the equalizer is a weapon of mass destruction, a dual-use space and missile program, supercomputer development, or the 1990s equivalent of the first Honda imports aimed at violent destruction or fierce economic competition, monitoring the migration—even the brain drain—of knowledgeable people and the acquisition of computers and telecommunications could provide indications of future potential competitors.

"Symbols that Bind" or Cripple.¹⁵

Sustaining North American economic power denies isolationist policy acceptance. Americans must communicate with and influence others to trade. International economic dependence depends on a policy of free information exchange. Symbols representing accounting for wealth must be exchanged beyond North America. Information will need to be imported and processed to add value for export. Future U.S. policymakers could be accountants and computer technicians!

The irreversible dependence on information between the North American information centers and other world information centers offers the prospect of growth through international trade. It also confronts us with vulnerabilities. A collegial international recognition that the world's information centers are reliant on continued exchange of valid information is vital. Furthermore, a gentlemanly approach that emphasizes mutual prosperity and shuns the crippling effects of information war is critical. The effect of international information war could be almost as staggering as nuclear

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war with economies dependent on world banks and trade being devastated
and worldwide depression following.

Restructuring to Exploit Open and Closed Information Seas.

How will the United States be affected when it becomes clear
that computer binary bits have become the standard of accounting
rather than the dollar? Is it then likely that their will be no
strong inherent advantage in international business for English
speaking and dollar using nations? Wouldn't it be prudent and
becoming the developed, information-intensive United States to base
decisions to compete or cooperate with foreign nations on current,
substantive knowledge. To open communications or emigration of brain
power ports, to increase mutual trade, to address environmental issues
when it is beneficial rather than after circumstances have changed so
greatly to condemn the U.S. government to anachronistic policymaking.

American schools and manufacturers could have more current,
accurate, and realistic information. American intelligence would have
a broader information base, especially in more third world countries,
and be able to apply information without tight restrictions to protect
sources and methods. Sensitive intelligence collection to corroborate
open sources would be required, but tasking loads for science and
technology or economic intelligence could possibly be reduced to allow
concentration on defense matters especially when significant direct
support to tactical military operations is vital. Like the god,
Argus, the United States could keep eyes on commercial and defense
information simultaneously.
Using Information Analysts To Analyze Not To Memorize.

What could be done to improve the effectiveness of U.S. domestic and foreign policy given access to the vast information ocean that awaits? Generally, the ocean could be continually drawn from to form readily searched open and closed information seas. Pre-sorting into seas could make development of timely user-specific information pools that offer immediate answers to EEIs. Such pools would immediately be of value to commerce and defense, in particular, to industrialists, economists, educators, scientists, political economists, demographers, intelligence analysts, and military planners and operators.

Today intelligence analysts produce topic specific pools, but they are usually restricted, closed information not available for commerce. Intelligence products are produced for topics that might never again be of interest. Large numbers of analysts each specialize in specific topics—a marching army—within which timely cross information exchanges is extremely difficult. Mind sets develop from the way humans generalize information for memorization and recall since it is beyond their capability to retain all details.

I suggest it would be more responsive, flexible, and beneficial to continually update the open and closed information seas, carefully keep the seas separated, and build the mechanism required to spontaneously compile EEIs and search for the information sea subset needed to extract a pool of user-required information—"just-in-time" information. Both open and closed source pools could advisedly be formed from two seas so policy requiring open incentives or coercion could use open source data and not compromise sources and methods used only in conjunction with the closed pool. Open pool information could be used to multiply the effect of closed pool information in a manner seldom exploited today. Today, open information is frequently melded
with closed information. Retrieving it from analytical intelligence products is time consuming and risks compromise.

For emphasis, the two seas represent first, the portion of the information ocean that was collected from open sources to be used commercially with some impunity and second, the portion that was collected by sensitive sources and methods to be used discretely to support perhaps international coercion or military power when required. Vannevar Bush may have predicted the current world situation and need to use the growing ocean of information in 1945, when he suggested that it was time to stop inventing "cruel weapons" of war and to make peaceful inventions. More than forty years of Cold War and an immense proliferation and refinement of "cruel" nuclear weapons interceded and the information oceans have expanded manifold times.

Let us re-focus the intelligence requirements of the United States to better collect knowledge, information, and data in this new priority order and yet retain the means to corroborate information to prevent deception and in case significant portions of the world may again resort to closed societies. Though the world is perhaps more dangerous than before it is arguably more open so it is feasible and more practical to collect and exploit the higher value knowledge and information from many sources, many of which are open. Collecting data and building intelligence products from the bottom up was necessary with major blocks of the world closed during the Cold War years. With greater focus on dangers to the United States from relatively open societies, the emphasis transfers to speedy collection and exploitation as well as banking information for redistribution to

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benefit United States commerce as well as defense. This shift to
speed, and the possibility of directly learning or deducing intent
from more open sources, argues for a focus on the high value added
knowledge directly from people and their commerce, then from non-
volatile sources such as publications, and lastly, on data. Much of
the data circulating in the third world was created by the United
States. We know the data. We need insight into their knowledge to
compete with foreign use of familiar data.

New Information Order.

Though reorganizations are always wasteful in the short term,
reorganization is typically justified when calamitous changes occur
like the end of the Cold War. Congress and the executive branch are
agreed that the intelligence community is in need of reconstruction to
address the developing new world order. The above refocus requires
anew the banking of large, fluid pools of information that must have
high liquidity to be of commercial and economic benefit. And there is
still the requirement for banks of knowledge and information (de-
emphasizing data except for vital bottoms up corroboration and
validation) to support military power that will require protection of
source and methods.

This presents the need for two information pools, one that is
open and highly liquid and a second that is closed and more responsive
that in the past because of our good fortune to be able to focus on
high value knowledge and information. It will be prudent to separate-
not totally isolate the organizations and architectures that process
these pools of information. Perhaps the creation of a commercial
information agency and a defense information agency supporting in
place of the thirteen agencies presently funded from the National
Foreign Intelligence Program. Two agencies that perform collection
tasking through information dissemination while any information user
whether commercial or federal could generate information requirements
to be submitted to and tasked by either of the two information
agencies.

As the value of information to politics, economics, psychology,
and military becomes vital, it should be recognized to the extent that
a Department of Commerce with a new Critical Information Division
(CID) and Department of Defense with an updated Defense Intelligence
Agency (DIA) may become a prudent approach to recognize that pooling
of information, openly for profit by commerce and behind doors for
sensitive source information for economic and military power, is
becoming central to national power. Denied areas have greatly
decreased and open sources of information could potentially provide
indication of improprieties such as nuclear weapons proliferation.
Sensitive collection means will still be essential but a turn to
processing the ore from the growing lode of open information will be
essential to meet mass and timeliness requirements to effectively
apply information power. Furthermore, without the concerns about
sources and methods it may be legal to open the pool to U.S. and
allies businesses. Military protection of ILOCs during war is also
likely to become necessary.

Figure three describes some of the potential uses of information
both domestically and externally through peace and various levels of
conflict. For simplicity, the executive agents for both open and
closed source information are reduced to the Secretary of Commerce
Critical Information Division (CID) and the Secretary of Defense
Defense Intelligence Agency (DIA), respectively, with the
administration of information and intelligence under a single Director
of National Information. The figure is a very sketchy notion of the
interaction of information means and management under many
circumstances. Any respectable treatment would easily require another
paper similar in magnitude to this one. Therefore, I hope the reader
limits use of the table to beneficial brainstorming and not to
bureaucratic mayhem.
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**FIG. 3**

SUPPPORTING RELATIONS
Conclusion.

The late 1800s geostrategic concepts developed into useful notional models for thought experiments in balance of power. This led to recognition that countries responded to actions by their neighbors and formed alliances with their non-adjacent neighbors to contain immediate neighbors now straddled by an alliance—an Occidental version of an enemy of my enemy is my friend. In the information age, such alliances should first of all emphasize rapport. Power will aggregate along stratification of users in world information centers—future "heartlands" of world power. Unlike the "heartland," information centers can develop in a portion of a nation or be formed by the interaction of portions of many geographically separated nations. Centers are not likely to respect current national borders. They will rise and fall in power far more quickly than currency-based economic power. Since economic power is enabled by information, economic power will follow changes in information power.

The DoD has been the source of most advanced U.S. technology. Technology that is often five-to-ten years more advanced than off-the-shelf state of the industry technology. If the end of the Cold War diminishes the need for a defense-driven technology base, let us foster an additional incubator for technology by building up the National Institute for Standards and Technology (NIST). NIST because it is situated in the Department of Commerce, open and accessible to advance commercial, medical, and environmental solutions, and because NIST is a major developer of advanced computing and vital standards required for things technical to communicate in a mutually understandable language. A DoC NIST Critical Information Division could begin filling the U.S. open information sea and providing the lead to put a personal computer within reach of every school child in
our country. DoC NIST and DARPA could guide and seed commercial
development of desktop computers at commodity prices that would make
it possible to put computers in all classrooms in the United States.
This could enable greater industrial competitiveness and provide
information and perhaps personal computers to be seeded generously in
lesser developed countries to develop markets and improve the quality
of life on the wrong side of the global village tracks.
The U.S. government must recognize the existence of great open
sources of information to grasp and process for an industrial and
environmental offense and to provide competitive technology
information that prepares U.S. industry for competition from companies
and products they might not have heard of before new products decimate
U.S. U.S. high-technology product markets.
To best exploit the information ocean, the United States should
take a new look at information’s role as an emerging national power
much like economic, military, or political power. The United States
should explore new means to rapidly collect and process the contents
of the information that will enable new applications and power.
Others are gathering the data, information, and knowledge. Our
government needs to draw on--purchase directly or lift from the public
domain, and process this data to accentuate and redirect information
masses to leverage information power in sustaining U.S. superpower. A
superpower is needed to lead sound development of the planet and the
new world order. Information may be joining wealth as both glue and
solvent that can reorder the world in the hands of a superpower’s
craftsmanship. It is not a zero sum game and developed and lesser
developed countries can mutually benefit. There is a growing ocean
of information, much of which is open source sea of information, which
treated properly permits uses not possible if the open information is not collected and maintained separately from closed source information. The growing open sea of information provides both the challenge and the opportunity for the United States to adapt and lead the world confidently into the next century.