GAIACOMM
International Corporation

4G Wireless Communications

- *20 Business Applications That Will Benefit from Gaiacomm's TeraHertz-Based Technology*

- *A Technical Discussion of TeraHertz (THz) Technology*

"Using Science to Turn Mystery into Mastery!"

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Applications Benefiting from TeraHertz-Based Technology:

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Applications Benefiting from TeraHertz-based Technology

- ***An Evaluation of 20 Applications & Their Current Status and Shortcomings.***
- ***How Gaiacomm Will Either Enhance Them or Resolve Those Shortcomings.***

FORWARD:

In recent years, the importance of 'terahertz light' has significantly increased. Existing in the region between light and radio waves, this light has rarely been used because there was no synergistic methodology to bring the technology to the application, i.e. there was no "pipeline" or a "bridge". The root term '**tera**' (10^{12}) refers to the frequency. It is more appropriate to refer to this frequency as 'infrared' instead of 'light'. Research utilizing THz light in imaging technology and new spectroscopic technology is underway around the world. THz light can be applied for measurements not only in the semiconductor field, but also in medical diagnoses and materials inspections. Recent advances in THz technology include new compact sources of broad and narrow-band THz radiation, THz receivers with lower noise and higher bandwidth, and electronic materials engineered for ultra fast carrier dynamics or enormous non-linear optics. Active systems for terahertz imaging with high spectral resolution have been demonstrated in the laboratory. Companies such as Intel Corporation (refer to article attached) have made great strides in developing transistors and miscellaneous components based upon terahertz theory.

Gaiacomm International acknowledges that theory and application must be brought together to become commercially viable and enable businesses to prosper. It has selectively identified applications that can quickly benefit from this marriage of theory and practical application of technology.

- **IMAGING AND RESOLUTION**
- **ANTI-TERRORISM MEASURES**
- **LAW ENFORCEMENT**

Airports are requiring mass inspections of persons and belongings before gaining access to plane areas, especially after September 11, 2001. This process is very time-consuming and is creating irate customers, causing delays in flight schedules, is increasing costs of operations, and still some explosive and biological entities cannot be detected. This is attributable to imaging and detection equipment unable to quickly inspect entities with accuracy, and provide a depiction of danger potentials.

- Gaiacomm proposes its technology can utilize terahertz processing for enhanced optical and resolution processes. Airport security can be refined and hastened. Entities can be identified with pinpoint accuracy and the results quickly relayed to authorities.

Ocean shipping and transportation carriers must register in-bound vessels so the US Customs can be prepared for cargo inspections. This is time consuming and many times inaccurate due to mis-inspection or non-inspection of cargo. The vessel must be at dock to have the inspections performed further exposing homeland security to a breach via explosives or bio-terror organisms contained within

the in-bound cargo. The expense of holding the cargo for Customs clearances is passed on to the consumer.

- Gaiacomm proposes its technology for the development of scanning equipment which can be applied at-sea reducing the threat of attack and encompassing the entire cargo for hazardous entities via micro-inspection imaging. The terahertz waves enable entities to report themselves, as if to say any entity has a "unique finger-print" not detectable with current equipment.
- Gaiacomm proposes its technology for not only ultra-fine resolution, but also in the rapid detection of wanted persons based upon camera-scans of large crowds of persons. Each person's image is relayed to law enforcement data centers, and if identified as "wanted", the person's location is rapidly communicated to local enforcement personnel.

Terahertz processes identify a person in similar fashion to a "finger print".

METEOROLOGY
ATMOSPHERIC MONITORING

The "green house" effect is of growing concern to scientists studying in particular the ozone depletion rate. Current equipment, including satellite imaging and photography, is myopic in being able to draw a time-series study of ozone depletion and predict points of damage.

- Gaiacomm proposes its terahertz technology can overcome this myopic condition as it enables time-photography without radiation to capture the entities releasing waves at various frequencies and without noise-interference from cross-reaction wave distortions of competing entities. Weather patterns emit strong energy transmissions indicating force and direction. Tornadoes and wind-sheer can be studied in-depth and clear resolution of energy development patterns would facilitate wind-sheer detection around airports for airline safety by re-direction of aircraft and warnings to in-bound aircraft.

Terahertz waves can be directed into energy formations to counter their effect, in effect creating an anti-effect to corral such harmful formations as tornadoes. This ability will stimulate development of wireless transmission applications built around the technology.

MEDICAL / DENTAL IMAGING
PROSTHESES

Dental examinations depend heavily upon X-rays for detection of decay in teeth and bone decomposition. Treatments are predicated upon the images received. Current technology not only fails to detect decay, but also exposes the specialist and patient to harmful radiation.

Mammograms are crucial for detection of breast cancer in females, yet current technology cannot detect some cancer presence, especially in women having implants or who are significantly overweight. This mis-diagnosis can provide enough time for cancer to spread into lymph nodes and surrounding tissue such that it transforms into a terminal cancer from one that could have been eliminated via surgery if detected accurately.

- Gaiacomm proposes its terahertz-based technology would enhance the development of scanning / imaging devices to detect and provide clear resolution, without harmful radiation to the specialist or patient, of anatomical imaging. Additional benefits would include the ability to image a patient's vein and artery structure in early diagnosis and treatment of heart disease.

Major advances in the manufacturing of artificial limbs have been held in check by problems not arising from the devices themselves, but with the communication transport of the signal between the neural devices and the prosthetic devices.

- Gaiacomm proposes its technology can enhance the development of neural devices enabling patients to operate mechanical prosthetic devices, such as arms and legs, to regain mobility and

independence by overcoming the problem of "noise and interference" from wireless devices used today. The terahertz band opens up a pristine frequency range in which neural impulses are not compromised.

- **COMMUNICATIONS**
- **ACCESS POINTS**
- **GLOBAL COMMUNICATIONS**

Across America, there are currently many "fiber rings" that are "dark" or without activity due to inability to cost-effectively connect them with businesses occupying complexes miles away. Two ways exist to connect to these metropolitan rings: local telephone company connectivity via dedicated lines, a very expensive and usually cost-prohibitive proposition and obtaining "right of way" to lay fiber optic cable or an alternate high-speed medium to connect directly with the ring, usually even more cost-prohibitive.

- Gaiacomm proposes that its terahertz-based technology can enable communications between the ring data exit-point and the business complexes already wired for wireless reception and exchange of high-speed data. The terahertz technology can enable exchange rates in excess of 100 frames per second, far faster than current DSL and broadband cable.

  This overcomes the cost-prohibitive aspects of business ability to utilize the Access Points and it revitalizes the "dark" rings to become functional, creating a revenue stream for municipalities and/or private interest groups that have investment in such infrastructure.

  Additional benefits derived include the ability to provide ultra-high speed Internet access to residential homes and small office / home office (SOHO-s) spurring an economic vitalization of a growing but under-served segment. Many corporations are not implementing work-from-home strategies due to the inability of the worker to communicate with the corporate office in a secure and fast mode of communication.

- **ENCRYPTION / COMPRESSION**
- **SECURITY**
- **MOVIES, HIGH-SPEED DATA TRANSFER**

Current technology does provide for high-speed data transfer and encryption / compression.
However, such transfers are not wireless and are exposed to hackers and other security breaches.

- Gaiacomm proposes that by using its terahertz-based technology, the available bands for secure transmissions are endless, and can be "wrapped" by side-bands which offer an impenetrable "coating" to safeguard such data. The speed of transmission is in excess of 100 frames per second.

Movies, voice encrypted messaging, and large blocks of data can be sent almost seamlessly via the "pipe" created by the Gaiacomm technology, without dependence upon existing networks. With the extreme transfer rates, the metropolitan Access Points now are available for re-distribution to a myriad of reception points around the world, but especially within the US.

- **AVIATION**

Storms are an everyday challenge to aircraft pilots. These storms present not only a visual barrier but also release energy patterns which wreak havoc with in-flight instrumentation. Even simple electronic items such as FM radios and cellular phones pose a problem to aircraft. In-flight telephones are very expensive due to the required safety features mandated so as not to interfere with the aircraft.

- Gaiacomm proposes its terahertz-based technology can function with high-resolution graphical display equipment presenting a clear view of 360 degrees for any aircraft at any point in time,

regardless of weather conditions. Telephone communication can be enabled at very affordable pricing that will be global in scope as it communicates over the Gaiacomm "pipe" and will not interfere with aircraft instrumentation.

- **IDENTIFYING SUNKEN SHIPS**
- **DEEP SEA EXPLORATION**
- **GEOLOGICAL DISCOVERY: OIL, COAL, NATURAL GAS, MINERALS, PRECIOUS METALS, etc.**

Speaking of storms and their tragic aftermath, according to the late Mel Fisher, legendary shipwreck salvage diver, "there's a shipwreck every hundred yards from Havana, Cuba to North Carolina [*Florida Trend Magazine, December 2002 edition, pg. 60*] and 20 to 30 wrecks … economically viable for treasure hunters to recover substantial caches [*ibid., pg. 59*].

- Gaiacomm proposes that its terahertz-based technology can locate and identify shipwrecks on the ocean floor and determine their composition and contents, as well as the condition of those contents, with its unique signature imaging properties. Salt-water has always proven to be a difficult medium through which to transmit and receive accurate imaging signals with its seemingly impenetrable cloak of salinity. Salt-water attenuation ("cloaking") has been solved with Gaiacomm's technology.

- **MILITARY APPLICATION: SUBMARINE COMMUNICATIONS**

Submarines must approach the surface for communications with ships, aircraft, and land-based facilities. Rapid bulk data exchange is not possible as the vessel submerges into the oceans to avoid detection. Maintaining stealth is not possible as the vessel is close to the surface and engaged in communication transfers. Salt water, due to its ionic bonding strengths, causes attenuation of signal and blocks 2-way communications. It functions as a giant cloaking device for signals within existing bands and frequencies.

- Gaiacomm proposes that its terahertz-based technology can enable a submarine to remain submerged at great depths, fully able to engage in encrypted communications with ships, aircraft, and land facilities. Salt-water attenuation ("cloaking") will no longer be a pervasive problem.

- **WEAPONS SEARCHES WITHIN CAVERNS**
- **WEAPONS – DESTRUCTIVE DELIVERY**

Caves and other under-ground obstacles are somewhat impenetrable, providing stealth hiding for terrorists and weapons of mass destruction by terrorist groups. Soldiers are exposed to dangers in searches from traps, ambushes, and suicide terrorists. Weapons locations must be visually identified.

- Gaiacomm proposes that its terahertz-based technology can provide high resolution images of caves, and locate weapons without exposing US soldiers to harmful fire from terrorists. It is also possible to transmit bursts of energy concentrations within the terahertz bands (terahertz radiation) and deliver a destructive impact not only to surface areas, but also within caverns and buildings – i.e. function as a weapon of destruction itself.

  This facility would negate the majority need for US soldiers to be exposed to hostile forces, most notably the Iraq conflict in which over 100 US and over 30 British soldiers were regrettably killed in action with Iraqi soldiers.

RECUE VEHICLE COMMUNICATIONS

Recent policy changes by the FCC have seriously affected **Rescue Vehicle Communications** restricting public access to the channels that these vehicles have depended on to communicate with emergency rooms and the doctors that staff them,

hobbling efforts to timely transmit life-saving medical information. These new directives, in effect, have forced crews to rely on cell phones that, given the status quo, may not be operational when most needed.

- Gaiacomm proposes that with its terahertz-based technology not only will communications be stronger, clearer and more reliable, but the number of channels available for public access is many and available for immediate usage.

Gaiacomm International Corporation's TeraHertz Technology (THz)

FORWARD

Gaiacomm International Corporation has developed and refined a communications system that is virtually wireless on all fronts. By using the natural frequencies generated by the Earth and other bodies, Gaiacomm determined that it is scientifically possible globally to transmit a signal of any strength to all parts of the planet up to and including inner space and outer space. In all respects, this means that a form of sub-space communications has been discovered using the governing dynamics existing in the electromagnetic spectrum that radiates globally and interstellar in all forms, including the sought after "Dark Matter" radiation.

The Gaiacomm technology proposes to operate within the Terahertz range.

A Brief Theory of TeraHertz (a/k/a THz) Radiation

Light at terahertz (1 THz = 10^{12} Hz) frequencies has become fashionable lately. There are several reasons for this:

- Innovative physics behind the new techniques to generate THz frequencies
- Many commercial and military applications of THz radiation
- Multi-applications of THz frequencies in fundamental research

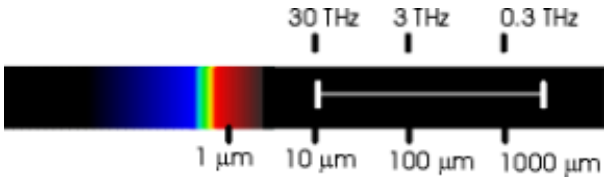

Fig.1: The white line is an approximate indication of the THz range

From the picture, you can see that we define it to run from approximately 0.1 to 30 THz, which, admittedly, is a rather broad interval.

Although THz frequencies are potentially very interesting, it took the development of a new technique to generate them to push them into the limelight. Traditionally, THz frequencies were generated by "heat sources" and detected with a liquid-helium cooled bolometer, essentially heat detectors. Additionally, there are the CO_2 pumped gas lasers and lately the free-electron laser, however the former only lases at discrete frequencies and the latter, due to its shear size, is not practical for many applications.

Hints of approaching changes were surfacing in the early seventies when Y.R. Shen generated THz pulses using optical rectification in $LiNbO_3$ crystals. (K.H. Yang, P.L. Richards, and Y.R. Shen, Appl. Phys. Lett. **19**, 285 (1971)). Similar work was also done by Auston and co-workers (D.H. Auston, A.M. Glass, and A.A. Ballman, Phys. Rev. Lett. **28**, 897 (1972)).

Optical rectification in a non-absorbing medium is a process in which a laser pulse creates a time-dependent polarization that radiates an electric field, which, in the far field, can be written according to $E(t) \propto \frac{\partial^2 P}{\partial t^2}$, where the polarization P follows the pulse intensity envelope.

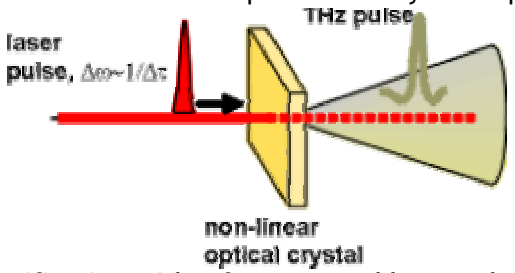

***Fig.2* Non-resonant optical rectification with a femtosecond laser pulse**

It is called rectification because the rapid oscillations of the electric field of the laser pulse are "rectified" and only the envelope of the oscillation remains. In the far field, this then changes into a pulsehape roughly sketched in the figure.

Since the medium is nonabsorbent, the polarization instantaneously follows the pulse envelope implying almost no limit on the speed at which the polarization can be switched on and off. The polarization radiates an electrical transient which typically consists of one or one-and-a-half oscillation of the electric field and therefore has a broadband THz frequency bandwidth. Bandwidths as large as 30 THz have been obtained using this generation mechanism (M. Joffre, A. Bonvalet, A. Migus, and J.-L Martin, Opt. Lett. **21**, 964 (1996) ; Q. Wu and X.-C Zhang, Appl. Phys. Lett. **71**, 1285 (1997)).

It is important to realize that optical rectification is a second-order non-linear process and can thus only take place in media void of inversion symmetry, i.e. Optical rectification will not occur in glass.

In absorbing media, behavior is different. In a (110) or (111) oriented semiconductor such as GaAs, THz generation can also take place by means of "non-resonant" optical rectification, but if the frequency of the laser is higher than the energy needed to excite electron-hole pairs, an additional THz generation mechanism can kick in, provided that the orientation of the crystal allows for it.

Suppose we place two electrodes on top of a GaAs wafer as shown in Fig. 3, and suppose we put voltage across these two electrodes.

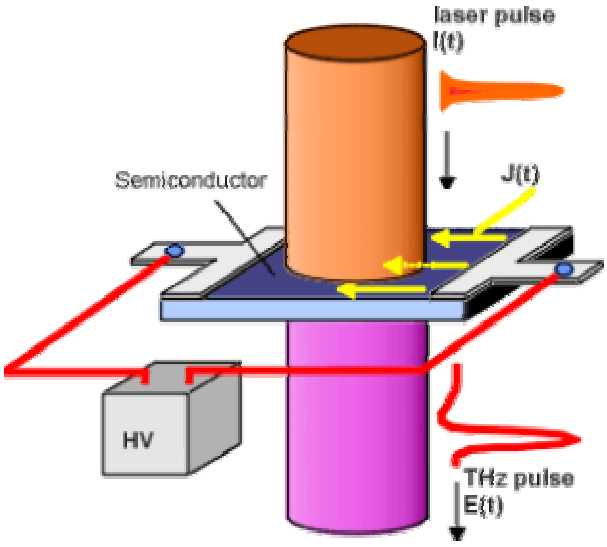

Fig. 3: Resonant THz generation in GaAs with a femtosecond laser pulse

If we illuminate the region between the two electrodes with a femtosecond laser pulse, the GaAs wafer suddenly becomes conducting where it behaved as an isolator before excitation. Under the influence of the applied electric field, a current begins to flow, which shows signs of saturation after approximately

0.5 picoseconds. Such a time-dependent current can also radiate an electrical transient, but with a higher efficiency than with non-resonant optical rectification. The frequency contents of this transient are determined by the transient behavior of the current and typically and roughly have a 3 dB bandwidth of 1 THz. This is less than expectations, based on the assumption that the frequency content is determined by the laser pulse duration, because it is not so based. Rather, it is determined by the current which can have a risetime slower that the laser pulse duration.

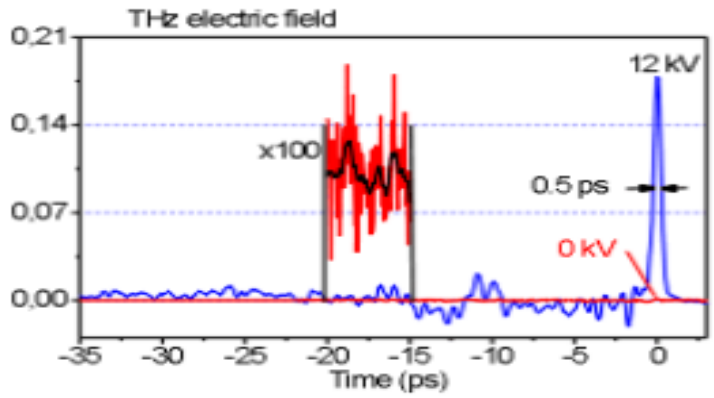

Fig. 4: **Measured THz electric field (vertical axis) versus time. Two measurements shown: the " black" is obtained when there is a voltage of 12 kV between the two electrodes and the "red" is obtained with zero bias. Multiplying the latter curve with a factor of a hundred shows noise level.**

We emphasize that this signal was obtained using a 1 kHz repetition-rate amplified Ti: sapphire laser and NOT with just a femtosecond Ti: sapphire oscillator. Oscillators, although they generate low power THz pulses, are much better suited for sensitive detection of THz pulses. The high repetition rate allows one to use phase-sensitive lock-in amplifiers. This more than offsets the lower power of the THz pulses and provides a superior signal-to-noise in the detected signal. The low repetition rate amplified laser, on the other hand, allows one to generate *high power* THz pulses. Depending on your application, either can be suitable.

The THz signal shown in figure 4 has some interesting features, not the least of which is that the signal appears to be a half-cycle pulse. That is, it appears to consist of only half a cycle of the electric field. Maxwell's theory states that in the far field, the integral over any time-dependent electric field should be zero. Since we are sure that we are measuring in the far-field, we appear to have a contradiction. Alternatively, do we? The answer is no. Although it cannot exactly be proven, it appears that the negative part of the electric field is there, but with a very small and long lasting amplitude, in effect making the integral over the electric field zero.

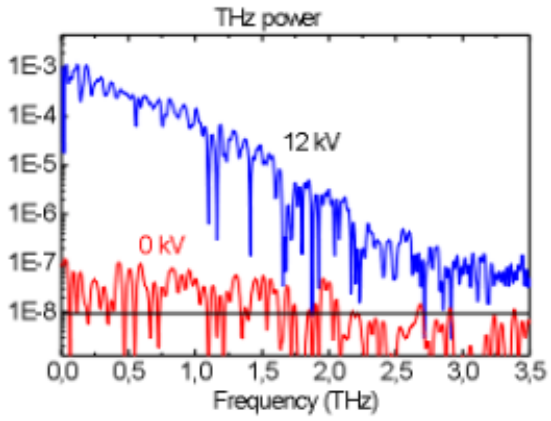

Fig. 5: THz power spectrum calculated from the electric field shown in Fig. 4.

Fig. 5 displays the frequency contents of THz pulses. In this particular case, this actually corresponds to the contents of our THz pulse, as the bandwidth of the detector, an electro-optic crystal, was chosen to be significantly larger than this. The figure clearly shows how the generation process favors the lower frequency components. Above 2.5 THz, not much useful signal remains. A final word remains for the detection process. Although we do not explain the detection process in detail, the detection study makes the entire THz generation field quite exciting. The detector is a gated process in which a synchronized laser pulse, co-propagating in the detector crystal (ZnTe or GaP) with the THz pulse, serves as the gate. Refer to Fig. 6.

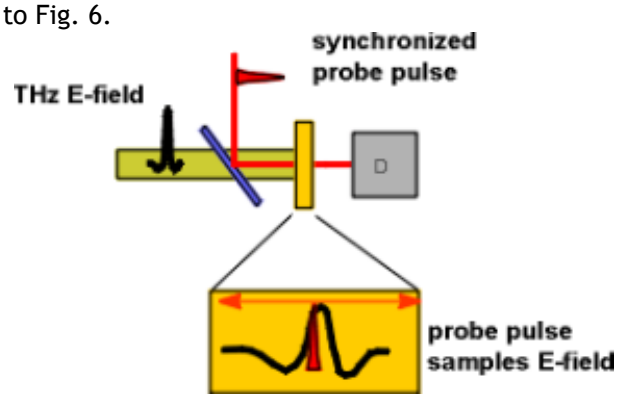

Fig. 6: Electro-optic detection of THz pulses with a synchronized laser pulse

The electric field of the THz pulse modifies the refractive index of the detector crystal, which induces a rotation of the polarization of the synchronized laser pulse. By varying the delay between the THz pulse and the laser pulse, the complete electric field is measured. All the information that one needs to know about the THz pulse is contained in the electric field. From the field, both information about the absorption of the THz pulse and the phase delays it obtains as it propagates through materials of varying refractive index, can be obtained.

The gate is open for as long as the laser pulse is on, which is typically 150 frames/second. During this time, virtually no photons from the thermal background radiation enter the detector. The detection process is therefore insensitive to the background radiation, which greatly increases the overall sensitivity. This is what makes it possible to detect THz pulses with such a great accuracy, accuracy much greater than what is possible with conventional Fourier-Transform spectrometers in this range.

A final point deserves some attention. Even if the laser that we use has a repetition rate of only 1 kHz, we can use a rapid scan technique to make relatively fast scans of THz signals in only 1 second. The method: a delay stage oscillates back and force at a repetition frequency of 1 Hz, with amplitude of several mm. The delay stage is the delay for the probe pulse used as the synchronized gating pulse. The GaAs wafer is biased at *500 Hz* and the detector signals from two subsequent pulses are subtracted. That is, we subtract a detector signal not containing THz info from a detector signal containing THz info. The difference signal is fed into an audio filter then into a computer that is doubly triggered, at 1 Hz and 1 KHz. In this way, we obtain a 15 ps delay scan of the THz signal, with a signal to noise of 30 in 1 second only, which is very convenient if you wish to optimize the alignment of your system based on the efficiency of THz generation. After averaging for some time, a dynamic range of more than 10^3 is obtained in the E-field.

The above data is used to demonstrate the validity of terahertz radiation.

PROOF OF CONCEPT

Prototypes are designed to test usability (intuitiveness) and functionality (does it work according to the design specifications).

Gaiacomm International Corporation proposes to design, build and test an imager camera / generator that will generate Terahertz waves and prove out the above applications on a case-by-case basis. The Company will construct a group of "black boxes" having the required instruments and components to be used to test a global communications system using terahertz waves and the magnetic field of the earth to carry the global signal. Six (6) boxes will be constructed and coupled with an antenna system as a base station to generate and broadcast to every other "black box" strategically placed around the world and embedded in the ocean floor to demonstrate that a signal can be broadcast anywhere at anytime. Various check and balance systems will be included along with extensive data to validate the "proof of concept phase". It will then become the basis for the actual prototyping of a working system, to include the camera imager that captures and transmits terahertz waves. All optics and substrates will be designed and tested by scientists working with Gaiacomm.

Four (4) months from time of funding are required to complete a "proof of concept" of the claim to transmit, generate and capture images for re-broadcast utilizing a global communications system.

SUMMARY

Gaiacomm International Corporation presents the above scenarios to initiate a thinking process for those persons seeking an answer to the question of what does Gaiacomm offer.

The terahertz-based technology will become the "core technology" of a myriad of wireless applications, and their development will spawn development of "add-on" devices and products.

The company primarily intends to demonstrate the commercial viability of its technology, and provide a "pipe" or "connector" that empowers synergistic relationships with manufacturers of wireless and other products to enable product mass inter-actions.

It is the goal of the company to take a lead role in bringing a fairly new technology within the grasp of the consuming public and the US military.

GAIACOMM
International Corporation

"To boldly go where no communications technology has gone before"

ADDENDUM # 1

MAJOR CORPORATIONS ALREADY HAVE A VISION OF *TERAHERTZ THEORY*

Intel Announces Breakthrough in Chip Transistor Design

New type of transistor and new materials combine to address critical power issues and help chips run cooler

SANTA CLARA, Calif., Nov. 26, 2001 -- Intel Corporation today announced that its researchers have developed an innovative transistor structure and new materials that represent a dramatic improvement in transistor speed, power efficiency and heat reduction. The technology development is an important milestone in the effort to maintain the pace of Moore's Law and remove the technical barriers that Intel and the semiconductor industry have only recently begun to identify.

The technology breakthrough, coupled with recent announcements from Intel on faster and smaller transistors, will enable powerful new applications such as real-time voice and face recognition, computing without keyboards, and smaller computing devices with higher performance and improved battery life.

"Our research has shown that we can continue to make smaller and faster transistors, but there are fundamental problems we need to address around power consumption, heat generation, and current leakage," said Gerald Marcyk, director of component research, Intel Labs. "Our goal is to overcome these barriers and produce chips that have 25 times the number of transistors of today's microprocessors at ten times the speed with no increase in power consumption."

Intel researchers will discuss two major elements of the new transistor structure at the International Electron Device Meeting (IEDM) in Washington D.C. on Dec. 3. Intel's technical papers will address power consumption, current leakage, and heat issues with two significant improvements to existing transistor design: a new type of transistor called a "depleted substrate transistor" and a new material called a "high k gate dielectric." Together, these advancements dramatically reduce current leakage and power consumption.

Power consumption as a limiting factor

As semiconductors become more complex and new milestones in transistor size and performance are achieved, power consumption and heat have recently emerged as limiting factors to the continued pace of chip design and manufacturing. Applying existing designs to future processors becomes unworkable because of current leakage in the transistor structure, which in turn requires more power and generates more heat. Transistors are the microscopic, silicon-based switches that process the ones and zeros of the digital worlds.

Intel has already developed the world's smallest and fastest CMOS transistors, including a 15-nanometer transistor, which will enable chips with up to one billion transistors by the second half of this decade. However, as hundreds of millions, and even billions of smaller and faster transistors get packed on to a single piece of silicon the size of a thumbnail, power consumption and the amount of heat generated in the processor core becomes a significant technical challenge. Using existing methods of semiconductor design would eventually lead to chips that are simply too hot for desktop computers and servers. These limitations could even prevent new chip designs from being implemented in smaller computers like mobile PC's and handheld devices.

"Smaller and faster just isn't good enough anymore," Marcyk said. "Power and heat are the biggest issues for this decade. What we are doing with our new transistor structure is helping make devices that are extremely power efficient, concentrating electrical current where it's needed."

The new structure is being called the Intel Terahertz transistor because the transistors will be able to switch on and off more than one trillion times per second. In comparison, it would take a person more than 15,000 years to turn a light switch on and off a trillion times.

Depleted substrate transistor

One element of the new structure is a "depleted substrate transistor," which is a new type of CMOS device where the transistor is built in an ultra-thin layer of silicon on top of an embedded layer of insulation. This ultra-thin silicon layer, which is different from conventional silicon-on-insulator devices, is fully depleted to create maximum drive current when the transistor is turned on, enabling the transistor to switch on and off faster.

In contrast, when the transistor is turned off, unwanted current leakage is reduced to a minimum level by the thin insulating layer. This allows the depleted substrate transistor to have 100 times less leakage than traditional silicon-on-insulator schemes. Another innovation of Intel's depleted substrate transistor is the incorporation of low resistance contacts on top of the silicon layer. The transistor can therefore be very small, very fast and consume less power.

New material replaces silicon dioxide

Another key element is the development of a new material that replaces silicon dioxide on the wafer. All transistors have a "gate-dielectric," a material that separates a transistor's "gate" from its active region (the gate controls the on-off state of the transistor). The record-setting transistors introduced in the past year had gate dielectrics made of silicon dioxide that are only 0.8 nanometers, or approximately three atomic layers thick. However, the leakage through this atomically thin insulator layer is becoming one of the largest sources of power consumption of chips.

At the IEDM conference, Intel researchers will demonstrate record speed for transistors made with a new type of material called a "high k gate dielectric." This new material reduces gate leakage by more than 10,000 times compared to silicon dioxide. The high k gate material is grown by a revolutionary technology called "atomic layer deposition" in which the new material can be grown in layers only one molecule thick at a time. The result is higher performance, reduction of heat, and significantly longer battery life for mobile applications.

The Intel Terahertz transistor solves a key barrier to bringing future chips into volume production that enable a completely new range of applications. Intel is expected to begin incorporating elements of this new structure into its product line as early as 2005.

ADDENDUM # 2

the White House
President George W. Bush

Taking Action to Improve Spectrum Management :	A Presidential Action

For Immediate Release
June 5, 2003

Fact Sheet on Spectrum Management

Taking Action to Improve Spectrum Management

Presidential Action

- President Bush signed an Executive Memorandum creating the Spectrum Policy Initiative to develop recommendations for improving spectrum management policies and procedures.
- The Department of Commerce will chair the Initiative.
- The purpose of the Initiative is to promote the development and implementation of a U.S. spectrum policy that will foster economic growth; ensure our national and homeland security; maintain U.S. global leadership in communications technology development and services; and satisfy other vital U.S. needs in areas such as public safety, scientific research, federal transportation infrastructure, and law enforcement.
- The existing legal and policy framework for spectrum management has not kept pace with the dramatic changes in technology and spectrum use. The Spectrum Initiative will help develop a U.S. spectrum policy for the 21st century.

The Importance of Spectrum

- Spectrum contributes to significant innovation, job creation, and economic growth. It is vital to scientific discovery and technological advances. It is critical to the ability of first responders to react to natural disasters and terrorist attacks and essential to the military's ability to fulfill its mission of protecting our nation.
- Recent years have witnessed enormous growth in spectrum-based technologies and uses of wireless voice and data communications systems by businesses, consumers, and government. Today, there are more than 140 million wireless phone customers and, increasingly, businesses and consumers are installing WiFi systems to allow wireless computing on their premises.
- The Federal Government makes extensive use of spectrum for radars, communications, geolocation/navigation, space operations, and other national and homeland security priorities.

How the Initiative Will Work

- The Initiative is comprised of two activities:

    1. The Federal Spectrum Task Force will produce a set of recommendations for improving spectrum management policies and procedures to increase the efficiency and beneficial use of spectrum by the Federal Government.

2. The Department of Commerce will hold a series of public meetings to assist in its development of a set of recommendations for improving policies and procedures for use of spectrum by state and local governments and the private sector.

- Within one year, the Secretary of Commerce will provide the President recommendations to:
    - Facilitate a modernized and improved spectrum management system;
    - Facilitate policy changes to create incentives to increase the efficiency and beneficial use of spectrum and to provide a higher degree of predictability and certainty in the spectrum management process;
    - Develop policy tools to streamline the deployment of new and expanded services and technologies, while preserving national security, homeland security, public safety, and encouraging scientific research; and
    - Develop means to address the critical spectrum needs of national security, homeland security, public safety, federal transportation infrastructure, and science.

Building on a Foundation of Success

While the Initiative will facilitate improvements in spectrum management, the Administration has achieved significant successes within the current system.

- The Administration has identified new spectrum for advanced third generation (3G) wireless services and technologies for consumers. In July 2002, the Department of Commerce released a plan in concert with the Federal Communications Commission (FCC) and the Department of Defense to make 90 MHz of spectrum available in the future for 3G wireless services while accommodating critically important spectrum requirements for national security.
- The Administration has identified how to make available additional spectrum at 5 GHz for wireless data communications, called Wireless Fidelity (WiFi). The Department of Commerce reached an agreement in February 2003 with the private sector and the Department of Defense on a technical solution that the United States is now able to present in international spectrum discussions.
- The Administration, in conjunction with the FCC, approved the use of ultrawideband (UWB) technology, which enables broadband connections and assists in the performance of critical safety services. During 2002, the Department of Commerce worked closely with the FCC to authorize mechanisms to accommodate UWB wireless technology without causing serious impact to critical radio communications services.
- The Administration has proposed several legislative changes and program initiatives to improve the spectrum management process, including: (1) providing the FCC with new authority to set user fees on unauctioned spectrum licenses; and (2) creating a Spectrum Relocation Fund to streamline the process for reimbursing government users, facilitate their relocation, and provide greater certainty to auction bidders and incumbents.

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http://www.whitehouse.gov/news/releases/2003/06/20030605-5.html

ADDENDUM # 3

Our Goal

Gaiacomm International Corporation's goal is to have data rates up to 100 Tbps (*tera-bits-per-second*). New design techniques are needed to make this happen at our desired target of one-tenth the cost of 3G (third-generation technology). The move to GWC (***Global Wireless Communications***™) is complicated by attempts to standardize on a single 3G protocol. Without a benchmark on which to build, designers face significant additional challenges. Gaiacomm International will define the new 4G protocol, therein removing any confusion, challenge or debate. Table 1 compares some of the key parameters GWC will have, and compares them to 3G.

TABLE 1: Key Parameters of 3G and Gaiacomm's GWC Technology

Technology	3G	GWC
Frequency band	1.8 - 2.5 GHz	1-29 HZ / 1-29 THz
Bandwidth	5 - 20 MHz	Over 300 THz
Data rate	Up to 2 Mbps (384 kbps deployed)	Over 100 Tbps
Access	W-CDMA	Gaia3
Forward error correction	rate 1/2, 1/3	Helix coding scheme
Switching	Circuit/packet	Packet bursts
Mobile top speeds	200 km/h	Switching 600 km/h min.

Wireless Communication service providers are slowly beginning to deploy 3G services. As access to technology increases, voice, video, multimedia, and broadband data services are becoming integrated into the same network. The grand vision of 3G as a true broadband service has not held up to the acid test and its disciples who once trumpeted it as such have shrunk away. We believe that 3G systems, while maintaining the ***possible*** 2-Mbps data rate as the standard, will ***realistically*** achieve only 384-kbps rates. To achieve the goals of true broadband service, the systems need to make the leap to a fourth-generation (4G) network. This is where ***Global Wireless Communications***™ (GWC) enters the fray and excels at it. This is not merely a numbers game. GWC will provide high-speed, high-capacity, low cost-per-bit IP-based services; fiberoptic wireless connections and a truly global wireless communications system operating in frequency ranges that surpass all other telecommunication companies on planet Earth.

GAIACOMM
International Corporation

ADDENDUM # 4

Dateline. October 27, 2003. Jacksonville, Florida.

Gaiacomm International Corporation Chooses Jacksonville

GAIACOMM INTERNATIONAL CORPORATION, formed to develop superior wireless communications utilizing terahertz technology developed by Founder and Physicist Dr. Judah Ben-Hur, has chosen Jacksonville for its new production facility and headquarters. The company is currently seeking funding for its startup and proof-of-concept development initiatives. Several sources have indicated a strong interest in funding this visionary technological breakthrough with the Gaiacomm technology.

The Board of Directors consists of Dr. Judah Ben-Hur, Chairman, Mr. David H. Horne, Jr., President and CEO, Mr. Dan J. Thomas, Jr., Executive Vice-President and COO, and Mr. Rob S. Cotton, Director of Human Resources. Ms. Brandie M. Halterman is Webmaster / Administrator.

The company's Board of Advisors includes several notables: Florida Commissioner of Education Jim Horne, former Florida DOE Chief Technology Officer Ruben P. Lopez, attorney-at-law, J. Allison DeFoor II, the 1990 Lt. Governor running mate of former Florida Governor Bob Martinez, and William E. ("Bill") Horne, President-CEO, Outback Sports, Inc.

Plans for Gaiacomm International Corporation include full development and commercialization of a global wireless communications protocol that is expected to revitalize a volatile telecommunications industry. The development of this proprietary – and closely safeguarded – technology will have a significant impact on the Jacksonville labor force, creating local employment opportunities for engineers of many disciplines, as well as abundant job opportunities for other non-engineering support positions, including many in high-tech, management and administrative fields.

"The next great business frontier will be found in the wireless communications industry, and innovative product developments for this field are central to the survival of every enterprise, regardless of company size or product volume. Every business is affected by the timeliness of communications, whether it involves its customers, its suppliers, or just its employees. Innovation is key to American companies keeping pace with the European and Asian markets in this decade, and critical in providing continuing careers in engineering and related scientific disciplines for students in our country's colleges and universities. We need to embrace new technologies that promise new business opportunities that will, in turn, strengthen the U.S. economy first and foremost, then the economies of the world." according to Gaiacomm EVP Dan Thomas. "In the wake of the ghastly events of 9-11, the U.S. economy and its employment numbers reeled, staggered, and dropped as an unanticipated result. Employment within the telecommunications industry was particularly hard hit, and is slow to recover. It is paramount that we seek a bold, new technology to help us compete on the world stage again, resurrect our economy, and create jobs for our university graduates and those persons displaced in the aftermath of 9-11".

"… and I believe we have that very technology at Gaiacomm." adds CEO David Horne. "Dr. Ben-Hur has given us a leg up on the competition with this new terahertz-based wireless creation of his. It has so many practical business applications beyond that of simple cell phone usage and computer connectivity that the greatest dilemma I face as President is resisting the temptation to open up too many lines of business at once. Apart from providing wireless telecommunications service, I could launch 9 distinctively separate applications tomorrow if I had the resources and the manpower to fund and staff them.

"I can think of three examples in the field of imaging alone, just off the top of my head. I would say that we could provide consulting services for subsurface exploration of oil, precious metals and minerals, both on land and at sea, using the unparalleled imaging capabilities that our new technology gives us.

Why use calculated risk scenarios to determine where you drill? Scientific? Yes. Infallible? No. Costly? You betcha! We'll tell you exactly where it is, how far down it is and what you'll likely encounter on the way down. Sunken ships, same thing. You want to dive on old shipwrecks looking for treasure; determine if your cargo vessel went down where you suspect and whether the cargo is salvageable? We'll tell you where to find the ship and what's on board without even getting our feet wet. All you would have to provide is the general location you wanted searched … and a modest fee for our services, of course.

"And speaking of cargo, security checks have become the major concern for airports and seaports today. The extraordinary problem they face is how to validate the contents of a shipment that passes through their authority without opening each package or container; and doing it expeditiously when there are thousands of parcels to inspect and certify for the public's safety. We could install our imaging technology at any port where cargo shipments from terrorists could be a problem, combine it with fail-safe detection software and within 90 seconds, scan over ten thousand parcels in an area the size of a football field and identify every weapon of mass destruction, terrorist device and pathogen known to the software.

"Our company's arrival on the business scene seems to me to be one born of kismet because there are suddenly a lot more of these "extraordinary" problems facing the world today that didn't exist a decade ago; and not to put too fine a point on it, we have a technological answer for the majority of them. This is an exciting time for all of us, and a bit scary, and I consider myself privileged to be helping Dr. Ben-Hur introduce this emergent technology with all of its marvelous benefits.

"Before this decade comes to a close, I envision a Gaiacomm workforce nearing 7000", Horne asserts. "That requires a lot of work for those of us who will be implementing the plans for an infrastructure that can accommodate that many employees and the applications they will need to develop and support in order to enter those markets competitively. Jacksonville will play a major role in it all because we plan to hire as many locals for the positions needed as is feasible".

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