ADVANCING USF INNOVATION

PHYSICAL SCIENCES
The Technology Transfer Office (TTO), Patents & Licensing was established in 1990 to facilitate the commercialization of university intellectual property, including patents and copyrights.

The TTO works with researchers and students in every college to ready new inventions for the patenting process and potential licensing opportunities. TTO’s work allows for a sustained focus on transferring cutting-edge research and innovation to the commercial marketplace, generating revenue and diversifying the economy.

Our office has a knowledgeable and professional staff with specialized backgrounds, who work in collaborative teams in the areas of marketing, patent prosecution and licensing to direct the movement of new ideas, discoveries and innovation into the commercial and public sectors. TTO endeavors to educate and promote innovation, the result of which is products, jobs and technologies utilized in the public interest.

[http://www.usf.edu/research-innovation/pl/about-tto/]
The University of South Florida is a high-impact, global research university dedicated to student success. USF is a Top 25 research university among public institutions nationwide in total research expenditures, according to the National Science Foundation. Serving over 48,000 students, the USF System has an annual budget of $1.6 billion and an annual economic impact of $4.4 billion. USF is a member of the American Athletic Conference. www.usf.edu

This past year, the university had a record 133 license and option agreements, ranking 9th nationally among individually reporting schools (comparison to the most recent available published data – AUTM 2014 survey). USF had 105 U.S. patents granted in FY 2016 and 90 for the 2015 calendar year, placing USF in the top 10 nationally among public universities for the past six years in generating new inventions. USF also had 9 new startup companies in FY 2016, and has facilitated the formation of 50 startup companies in the last 5 years.
Page #  Area of Interest
5     Sensing
8     Optics
9     Imaging
11    Materials
15    Electronics
16    RF and Microwave Engineering
19    Location Based Services
20    Telecommunications Systems and Techniques
25    Energy
27    Environment
29    Cybersecurity
30    Unique Technologies
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Miniaturized Sensor Node with Machined Substrate Antennas for Wireless Monitoring

A high-efficiency 3-D harmonic repeater for narrow band, wireless sensing applications. This approach provides for remote calibration of passive sensors using orthogonal polarization of the interrogation signal for narrow band, wireless sensing applications. It far exceeds currently available designs, in terms of conversion gain, communication range, and occupied electrical volume.

USF Tech ID 12B128
US Patent 9,093,741

Continuous Wireless Powering of moving Biological Sensors

A system for wirelessly powering moving biological sensors without the need of batteries. The system is able to deliver a constant power supply, eliminating power related drifts and their corresponding recalibration procedures.

USF Tech ID 15A052
US Patent Pending

Interferometric Optical Bench System on a Chip

A self-contained Micro-Optical Electro-Mechanical based Interferometer Optic Bench System (MIOBS) designed to quickly detect chemical signatures by use of its laser sources, semiconductor photo detectors, refractive/reflective optical elements and specialized optical transmission paths. This technology is applicable in industries such as engineering and life sciences where there is a need to detect chemical species as well as biochemical compositions.

USF Tech ID 08A044
US Patent 8,269,974

Fiber Optic Probe Capable of Simultaneous Absorption and Emission Measurements

A dual sensing system that simultaneously absorbs and emits measurements using a single fiber optic probe. An unclad fiber is immersed in the medium of interest and absorption of the evanescent wave extending into the medium is observed. Also, the fiber can be coated with a polymer which produces a much higher concentration of the solute in the region surrounding the fiber, making it easy to get a clear signal either in the absorption or emission mode.

USF Tech ID 07A046
US Patent 7,855,780
UV-LED and Laser Fluorescence for Monitoring Water Quality

An innovative method for detecting trace levels of dissolved organic contaminants and potentially harmful substances in drinking water by use of a deep ultra violet light emitting diode LIF system. The system consumes approximately one thirteenth of the average laser power making it cheaper, compact and portable. This highly sensitive system does not use reagents or chemicals making it superior to systems currently on the market.

USF Tech ID 06B106
US Patent 7,812,946 and 8,467,059

Portable Light Emitting Diode (LED) Photometer for Colorimetric Measurements

A device that provides an inexpensive and accurate way to perform colorimetric measurements in the field. For each measurement, the LEDs are activated alternately and the signal of all wavelengths are sent to a microcontroller for data processing. This inexpensive device is easy to operate, highly accurate and precise. Can be widely used in aquarium management, aquaculture and for teaching purposes.

USF Tech ID 12A037
US Patent Pending

Microfluidics Platform for Microsphere Positioning

A device with a novel fluid channel designed to enable the microsphere to be easily and reversibly positioned for optical sensing, without the need for a stem. As a result the platform can be reused for measuring multiple microsphere resonators or those coated with targeted bio-species. Such a platform lessens the bulkiness of the device and significantly reduces the time required for calibration.

USF Tech ID 12B118
US Patent Pending

Fiber-Optic Temperature Sensor

This sensor is simple, versatile and novel in design with an electrically inert tip. The self-heating capability of the probe compensates for poor thermal contact with the sample and conducting heat loss. As a close-loop system it can follow a temperature profile which is a valuable capability for numerous industrial applications.

USF Tech ID 04A018
US Patent 7,104,683
Thermally Compensated Tandem Differential Thermometer

A thermally compensated thermometer capable of highly accurate determination of surface temperature. This technology uses a probe with a single crystal of Yttrium Aluminum Garnet fiber terminating in a laser heated phosphor. The thermometer developed is immune to electromagnetic interference.

USF Tech ID 06A063
US Patent 7,789,556 and 8,011,827

Angularly Partitioned Evanescent Wave Absorption Sensor

The evanescent wave absorption sensor is based on the principle that any propagating ray in the core of an optical fiber penetrates slightly into the cladding, and therefore will be attenuated if the cladding is absorbing. If the cladding is replaced by a sample chemical, the absorption characteristics of the sample can be studied. This invention is capable of measuring a much larger range of absorptions with high accuracy for a fixed interaction length.

USF Tech ID 09A013
US Patent 8,592,768

Compact, High–Efficiency Sensor Node for Embedded Wireless Monitoring

A compact, energy-efficient, passive and wireless vibration sensor node for embedded monitoring. The compactness and high efficiency of the node were achieved by employing 3-D, machined-substrate small antennas on the transceiver. The field tests for this invention have revealed it to be potentially useful in long range embedded passive sensing.

USF Tech ID 13B137
US Patent Pending

Chemical Sensors Using Micro-Cavity Technologies

This is an ultra high sensitive chemical sensor which can be used in chemical, pharmaceutical, food, and beverage industries for quality control purposes. Its compactness and durability makes it suitable for space missions where chemical sensors are in a great need for biomedical experimentation, the monitoring of water, and air recycling process.

USF Tech ID 15A045
US Patent Pending
Fabrication of 3-D Ion Optics Assemblies by Metallization of Non-conductive Substrates

Technique to simplify the fabrication and assembly of cylindrical ion traps (CITs) for mass spectrometers and other ion/electron beam instruments using new materials such as low temperature co-fired ceramics (LTCC). This invention has the capability to improve the precision as well as control the patterning of the conducting layers while reducing the complexity involved during fabrication.

USF Tech ID 05A006
US Patent 7,700,911 and 8,188,422

Method and Apparatus for Projecting an Image in Free Space

An optical device that projects a 3D image into free space in front of the device, allowing an observer to focus on the reflection much closer to their eyes. It uses a pair of parabolic mirrors placed in a unique orientation. This invention is can be utilized in so many applications such as perfecting the pose during sports practice.

USF Tech ID 07A054
US Patent 8,210,694

Two-Dimensional Optical Filter and Associated Methods

The new 2D optical spectrum analyzer provides a filter adapted to separate a multi-frequency, 2-dimensional image into spectral components. The filter objectively retains the integrity of the image and its wavelengths may be observed on either a charge couple device (CCD) or another type of display. This technology is marketable in fields such as component testers, spectrum analyzers, opto-mechanical hardware as well as laser measurement.

USF Tech ID 99B040
US Patent 6,697,557
Variable Tomographic Scanning With Wavelength Scanning Digital Interference Holography

This technique allows non-invasive imaging of tissues such as retina, skin and gastrointestinal epithelial tissues with speed and enhanced capabilities. This process improves the approach to calculating images of tomographic microscopy which enables clinicians to visualize the anatomic structure and evaluate the functional performance of the body’s internal organs and tissues in a more flexible scanning range.

USF Tech ID 05A065
US Patent 7,486,406

Total Internal Reflection Digital Holographic Microscope

Total Internal Reflection Holographic Microscopy (TIRHM) is a method capable of overcoming the challenges of noise reflected from the cell body beneath during conventional cell surface morphology and in so doing generate quantitatively precise images of live cell-substrate interface. This process observes ligand-receptor interaction for purposes of drug discovery.

USF Tech ID 07A018
US Patent 7,812,959 and 7,880,891

Full Color Holographic Camera Technology

This technology has the capability of capturing color holographic 3D images under all common illuminations including outdoor, daylight, room light, halogen, LED, and others. With color self-interference incoherent digital holography (CSIDH), this device has better resolution, inherently faster processing speeds and has potential to do video. It has applications in the areas such as security, inspection, scientific imaging, and online advertising.

USF Tech ID 13A029, 13B183, 12A040 and 14B101
US Patent 9,377,758; 9,360,299

Full-Color Full-field Optical Coherence Tomography

This is a method for surface and sub-surface imaging of biomedical tissues. The imaging method is applicable to the diagnosis of diseases, especially in the critical areas of optical coherence tomography (OCT), such as ophthalmic and dermatological imaging. The invention provides a full color 3D microscopic imaging systems and methods utilizing widefield optical coherence tomography resulting in a machine capable of lateral and longitudinal resolution, subsurface penetration of diffuse media and full natural color representation.

USF Tech ID 03B111
US Patent 7,317,540 and 7,095,503
Wavelength Scanning Digital Interference Holographic Microscopy

A digital holographic method has been developed. It allows for reconstruction of 3D objects with very narrow depth of focus and high axial resolution. It allows complete suppression of out-of-focus images. A number of optical holograms are generated using different wavelengths spaced at regular intervals.

USF Tech ID 99B034
US Patent 7127109

Adaptive Optics Ophthalmic Imager without Wave front sensor or corrector

A novel adaptive optics ophthalmic imager that does not require the use of separate hardware devices has been developed. This will ultimately reduce manufacturing and maintenance cost. The waveform sensing and correction has almost full resolution of the CCD camera. In addition, the new aberration correction system can be easily incorporated into a conventional fundus camera to achieve high resolution imaging of retinal cone mosaic.

USF Tech ID 10B110
US Patent 9,179,841

Quantitative Phase-Contrast, Line-scanning Confocal Microscope

A system that can be used to capture high-quality intensity images of optical sections and obtain a quantitative phase map for each optical section at a high speed. This is achieved by combining the merits of line-scanning confocal systems with digital holography imaging.

USF Tech ID 14A089
US Patent Pending

3-D Imaging System with Pre-Test Module

A 3-D imaging system for underwater profiling that is capable of minute definition. The system uses a novel angular relationship to establish the relationship of the image features to the system which is displayed by the virtue of calculations. In addition to the static surfaces, moving surfaces may be studied and corrections due to turbidity and platform position are also easily compensated.

USF Tech ID 03B066
US Patent 7,796,809
Template Electrodeposition of Free-Standing Aluminum-Manganese

It has been demonstrated, for the first time, the feasibility of template electrodeposition of Al-Mn nanorods, micro-tubes and micro-pillars with tunable sizes and compositions. By combining the easy processing route, inventors have developed intrinsic scalability, and this presents immediate contribution in applications, such as plasmonic pixels in color display, anodes for Li ion batteries, or energy absorbers.

USF Tech ID 14B145
US Patent Pending

Manufacturing Micro-Or Nanostructures by Means of Wet Chemistry in a Confined Space

A novel technique to fabricate ZnO nanowires inside an array of high aspect ratio deep trenches. Such a structure may be beneficial when Zinc Oxide nanowires are used as an electrode material for devices like DSSCs, supercapacitors or any other electrochemical device.

USF Tech ID 12B093
US Patent 9,443,662

Electrodeposition of Al-Ni Alloys and Al/Ni Multilayer Structures

This is a feasible and cost-effective alternative method to fabricate Al alloys and multilayer structures by electrodeposition in non-aqueous room-temperature ionic liquids. Specifically, they have identified a method of dissolving NiCl₂ in 1-Ethyl-3-methyl Imidazolium Chloride/Aluminum Chloride electrolyte to provide good conductivity, low vapor pressure, and a wide electrochemical window; all of which are limited in current conventional practices.

USF Tech ID 15A033
US Patent Pending

Shape-Morphing Space Frame (SMSF) Using Linear Bi-Stable Elements

This is an improved structure and methodology that provides a predictable and controllable space-frame change that allows the morphing of one specific shape into a different shape. The ability to change the surface profile upon actuation can be implemented in various applications, such as deployable antennas, airplane wings, morphing, and fluid flow controller. There is a potential for this method to be manufactured a the micro-scale to be used in medical applications, such as intravascular stent.

USF Tech ID 15A088
US Patent Pending
Smart Conducting Polymer Composite Actuator in Moist Air

This invention is a flexible electrochemical composite polypyrrole (PPY) film which actuates with moist air. The free standing PPY–composite film responds to moist air by freely moving forward and backward, indicating that it can be easily integrated in toys. Our film can also be used as humidity sensor, capacitor, and robotic works.

USF Tech ID 14B156
US Patent Pending

Novel Processing for High Specific Capacitance in Supercapacitor Applications

This approach is transformative and fundamentally different from any existing nanocomposite electrode formation processes, yielding a higher specific capacitance for supercapacitor applications. This process can be applied to the fabrication of battery and supercapacitor electrodes using various conducting polymer composites and conducting polymer materials.

USF Tech ID 16A014
US Patent Pending

Design and Kinematic Optimization of a Waterproof Shape Shifting Surface

This is the combined structural integrity of a Shape Shifting Surface (SSS) with the water-tight seal of a flexible plastic sheet to create a surface which would be strong, flexible, and waterproof. Solid mechanisms theory was used to analyze the behavior of the part using the virtual work method.

USF Tech ID 15A069
US Patent Pending

Load-Adjustable Constant-Force Mechanisms

This is a compliant device with adjustable constant-force output. In order to fulfill the need for precise force output control in robotic systems, our inventors have designed a CFM that is easily adjustable in a way that directly affects the output force. Robotic armatures could also employ this system in their joints to maintain static balance in a wide range of positions, improving power efficiency.

USF Tech ID 16B130
US Patent Pending
### A Limina-Emergent Cone Using Bistable Collapsible Compliant Mechanism

This invention is a cone structure using bistable collapsible compliant mechanism technology. The transformation from a planar lamina shape to a cone shape requires only small pulling or compressing force to switch between the two states. It will provide useful functions such as switches and relays, and can be manufactured on a microscale.

**USF Tech ID 16A031**
**US Patent Pending**

### Shape-Morphing Space Frame (SMSF) Using Unit-Cell Bistable Elements

This is a method to allow for the design of a structure, called the Space-Morphine Frame, that can change from one specific shape to another using unit-cell bistable elements.

**USF Tech ID 15B172**
**US Patent Pending**

### Dual Ligand Sol-Gel Sorbent Combining Superhydrophobicity and π-π Interaction

These are silica- and germania-based sol-gel sorbents containing two organic ligands characterized by superhydrophobicity and π-π interaction with the analytes. The created sol-gel sorbents provide stable, consistent performance in the extraction of analytes from saline and non-saline aqueous matrices. This new material is optimal for solid-phase microextraction and is easy to couple with many modern analytical techniques.

**USF Tech ID 16B181**
**US Patent Pending**
### Thermoelectric Flow Cloaking Via Metamaterials

This is a method based on transformation optics for unprecedented control of thermoelectric flow. Transformation optics has proven to be a versatile approach to achieve such unusual outcomes relying on materials with highly anisotropic and inhomogeneous properties.

**USF Tech ID 16B194**
US Patent Pending

### Biocompatible Hybrid Sorbent for the Extraction and Enrichment of Catecholamine Neurotransmitters

This is a metal oxide-based biocompatible hybrid sorbent for the extraction and enrichment of catecholamine neurotransmitters. These sorbents can be advantageously employed in the extraction and enrichment of catecholamines and their metabolites which represent important biomarkers for neuroendocrine tumors.

**USF Tech ID 16A106**
US Patent Pending

### New Method for Producing Flexible Conducting Polymer and Polymer Nanocomposite Films

This is a new method for producing flexible conducting polymer and polymer nanocomposite films. This invention address previous problems by devising a method which allows the transfer of thin PANI (Polaniline), other conducting films, and polymer nanocomposite films to flexible polymer, copper, aluminum, and other substrates.

**USF Tech ID 14A072**
US Patent Pending

### Design of a Linear Bi-Stable Compliant Crank-Slider Mechanism

This is a new model for a linear bistable compliant mechanism and design guidelines with step-by-step procedures for customization. This type of design can be used in Shape Shifting Surfaces as an attachment to provide more stability to its surfaces.

**USF Tech ID 15A087**
US Patent Pending
Microelectromechanical Slow-Wave Phase Shifter  
Method of Use

This is a device and method that improves upon the capacitance-only TTD device architecture. The slow-wave device in accordance with the present invention produces true time delay phase shifting that enables large amounts of time delay without significant variation in the effective characteristic impedance of the transmission line.

USF Tech ID 03B108  
US Patent 7,767,903; 7,259,641

Microfluidic Enabled Low Cost Beam Scanning Arrays

This novel microfluidic reconfiguration technique alleviates the need for active RF switching devices by utilizing antenna elements consisting of liquid metals or metalized plates movable within interconnected microfluidic channels placed at the focal surfaces of microwave lenses. This invention can be widely used in commercial millimeter-wave applications such as satellite communications and microwave imaging. It also can be utilized for military and meteorology applications.

USF Tech ID 13A003  
US Patent Pending

Dynamically Reconfigurable Bandpass Filters

This is a RF filter in which frequency tuning is accomplished by movable microfluidic loads consisting of metal (in either liquid or solid form) and dielectric solution volumes. The highly linear nature of the tuning mechanism makes these novel filters well suited for high-power RF applications. Additionally or alternatively, the filter can be fabricated to have a miniature footprint making it suitable for small appliances.

USF Tech ID 12B158  
US Patent 9,325,047

Programmable Magnetic Energy Minimizing Co-Processor (MEMCOP)

This is a physics-inspired computation that maps quadratic energy minimization problem spaces into a set of interacting magnets, so that the energy between the problem variables is proportional to that of the energies between the corresponding magnets.

USF Tech ID 15A103  
US Patent Pending
**Zero-Order Energy Smart Antenna and Repeater**

This is a novel invention for a device that consists of two smart ZOE Antenna which will be configured for optimum signal reception at power up, then sampled and reconfigured at user defined time intervals. The antenna performs these adjustments while consuming approximately Zero DC energy.

*USF Tech ID 05B122
US Patent 7,720,437*

**Dual Polarized Feed Antenna Apparatus and Method of Use**

This is a novel method and device for the collection of electromagnetic energy using a dual polarized antenna for the collection of solar energy, overcoming the identified deficiencies of prior systems. The device intercepts randomly polarized electromagnetic waves which is excited through an aperture by using two well-isolated orthogonal feeds. This invention will be most beneficial in the energy and communication industries.

*USF Tech ID 05A034
US Patent 7,619,570; 7,362,273*

**Periodic Spiral Antennas**

This is a novel periodic spiral antenna that utilizes a combination of the z-direction and a tapered substrate profile to provide for volumetric miniaturization of Ultra-Wideband (UWB) spiral antennas. The interleaved spirals form multiple turns of the antenna and the turns are equally spaced from each other throughout the antenna.

*USF Tech ID 13A106
US Patent 8,922,452*

**Mechanically Reconfigurable Antennas**

This is a design of adiabatic dynamic differential logic for differential power analysis (DPA). This technology has a wide range of applications including virtually any cost sensitive secure integrated chips.

*USF Tech ID 11B196
US Patent 9,263,803*
<table>
<thead>
<tr>
<th>A Dual-Feed Series Antenna Array with Frequency Independent Beam Angle</th>
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<tbody>
<tr>
<td>This is a method for antenna array design that enables the direction of signal transmission and/or reception to remain fixed as the operating frequency changes. The functionality is useful for frequency hopping communication applications to maintain the communications link when the transmitting frequency changes.</td>
</tr>
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</table>
| USF Tech ID 08A006  
US Patent 8,063,832 |

<table>
<thead>
<tr>
<th>Flexible Low Profile Microwave Antenna</th>
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<tr>
<td>An innovative antenna that uses a flexible substrate with embedded elements to provide frequency tuning. The design consist of a printed dipole that is loaded with two parallel sleeves, and has parasitic capacitive loading at the ends of the dipole arms; the loading elements offer miniaturization of the design. This design is attractive due to its high radiation efficiency and inherently broad bandwidth.</td>
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| USF Tech ID 09B103  
US Patent Pending |

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<tr>
<th>Magnetically Tunable Nanocomposite Polymer for Microwave Applications</th>
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<tr>
<td>A low-loss nanocomposite polymer with high permeability and permittivity has been developed. This invention provides the high-speed digital electronics and communications industries with a high performance material that can lower the weight, size and cost of products based on microwave laminates.</td>
</tr>
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| USF Tech ID 10A068  
US Patent Pending |

<table>
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<tr>
<th>Miniature Broadband Composite Right-Hand Left Hand Microwave Phase Shifter</th>
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<tr>
<td>This is a composite right hand left-hand (CRLH) microwave phase shifter that simultaneously offers constant phase shift over a broad frequency range, excellent impedance match in all states, low insertion loss and very small footprint. This invention enables improvements to microwave communications and radar systems, by improving the performance and lowering the cost of electronically-steered phased array antennas.</td>
</tr>
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| USF Tech ID 11B153  
US Patent Pending |
Micro-wireless Integrated Environment Sensor and Transmitter system

The technology is a sensor and sensor system comprising radio frequency IC adapted as an environment micro system for the sensing of environment stimulus and communications. The overall system combines sensor and communication functions as one to provide data for the surrounding environment in which the system is employed or in use.

USF Tech ID 01B085
US Patent 7,386,289

An Aperture Rectenna for Converting High Frequency Wave Radiation into DC Power

The invention allows the collection of solar radiation from the wave property of light and the conversion of this electromagnetic wave energy into direct current electrical energy by the use of an integral ultra high frequency rectifier. It offers an integrated approach, at the nano scale level, to fabricate a slot or aperture antenna integrated with a MIM quantum tunneling diode to form a building block element in an array of rectenna elements for harvesting electromagnetic energy.

USF Tech ID 03A023
US Patent 7,091,918

Integrated MEMS Wireless System in 3D Package

A highly miniaturized wireless transceiver employing WLAN technology that offers flexible integration with multiple, generic sensing technique. It can be readily integrated with existing sensing technology to enable direct sensor-to-internet communication in environments where wired connections are impractical.

USF Tech ID 04A026
US Patent 7,656,673

RF Microwave Circuit and Pulse Shaping Method

New pulse shaping method for pulse shaping, referred to as the Multiport Circuit for simultaneous Shaping of Sub-nanosecond Pulses (MCS3P), that involves the use of coupled transmission lines, which isolates the pulse generator from the pulse-shaping network.

USF Tech ID 07B140
US Patent 8,134,394 and 8,248,125
Navigation System for Obstructed Signals

A system and method of manipulating device positioning systems to reduce the impact of harsh GPS environments on its battery life when located at an obstructed location. Devices in such locations are identified based on historical data collected on the mobile device over time, real-time data as well as changing device positioning recalculation frequency settings.

USF Tech ID 11B151
US Patent Pending

Systems and Methods for Efficient Real-time Location-aware Applications

An intelligent software implemented in state machines that dynamically adjusts software parameters in Location-based Services (LBS) applications in real-time based on environmental conditions. Control of the changes of state in an LBS system saves power by reducing polling intervals of location technology at times when they are not necessary. This software also increases application performance and reduces network bandwidth consumption.

USF Tech ID 07B079 and 07B080
US Patent 8,036,679

Evacuation Zone Finder System and Application

A mobile application that actively determines the user’s current location, compares it with data from the Geographic Information Systems (GIS) maps and then notifies the user with the corresponding evacuation zone designation with necessary instructions for adequate reaction. In so doing, the application assists in safe and timely evacuation of persons in at risk areas.

USF Tech ID 05B097 and 05A048
US Patent 8,145,183 and 8,045,954

GPS-based Real-time Location-based Services Applications

A real-time transit navigation system to track the location of public transit riders (who might or might not be familiar with their route) and transit vehicles by providing notifications based on comparisons of the location of the riders and vehicles. This technology promotes the use of public transportation there by lessening traffic congestion, reduce consumer travel costs as well as reduce environmental pollution.

USF Tech ID 04B083, 05A060 and 07A055
US Patent 8,138,907
Physical Layer Security and PAPR Mitigation in OFDM Systems

This a technique that inserts artificial/irrelevant data into the OFDM signal of the legitimate transmitter on the fading frequencies of the wireless channel between legitimate users. In addition to the security, the invention utilizes the irrelevant data for PAPR mitigation rather than inserting an arbitrary data. PAPR reduction is achieved without using any extra spectral resource and bit-error-rate performance of the communication is improved with the lower cost power amplifiers.

USF Tech ID 14B149
US Patent Pending
Information Beamforming for Visible Light Communication

This is a technique in which beamforming is performed in the information domain without hurting the illumination. The invention addresses the controlling of the data directionality in VLC without hurting the ability to illuminate a space.

USF Tech ID 14B159
US Patent Pending

Suppressing Alignment in OFDM-Based Systems

This technology is a novel approach called Suppressing Alignment to reduce the out-of-band interference and peak-to-average power ration of Orthogonal Frequency Division Multiplexing (OFDM) systems.

USF Tech ID 14B154
US Patent Pending

A Windowing Technique for Optimal Time-Frequency Concentration and ACI Rejection in OFDM-Based System

This is an alternative solution for reducing OOB radiation by using a method of concentrating the spectrum of windowing functions into a given bandwidth while achieving maximum suppression in the out-of-band region. This approach preserves the main structure of OFDM receivers and addresses back-compatibility issues which are important for existing OFDM-based systems.

USF Tech ID 15A029
US Patent Pending

Side Lobe Suppression of OFDM-based Cognitive Radio Systems Using Adaptive Symbol Transmission

Using licensed frequency bands through cognitive radio systems as a solution to spectral crowding problem. With only a small increase in the useful symbol energy, this technique reduces interference to adjacent signals significantly. Interfering side lobe suppression is achieved by adding an extension to OFDM symbols that is calculated using optimization methods to minimize adjacent channel interference while keeping the extension power at an acceptable level.

USF Tech ID 07B092
US Patent 8,571,136
Cognitive Positioning System

An innovative cognitive positioning system that provides arbitrary positioning accuracy with optimum complexity in both indoor and outdoor environments. This system is based on the Adaptive Time-of Arrival concept and consists of two major components, namely, bandwidth termination and hybrid overlay and underlay dynamic spectrum access (H-DSM) algorithms.

USF Tech ID 07A007
US Patent 7,956,807

Increasing the Reliability of OFDM-based Communication Systems

Implemented to improve probability of successful reception at the receiver and transparent self-healing and fault-tolerance of the communication. Inventors have employed diversity coding across OFDM sub-channels to improve spectral efficiency, transmission rate, throughput and performance during multipath fading, without requiring rerouting or retransmission of lost information. DC-OFDM provides the best performance when the probability of link error is high or when a link (sub-channel) fails.

USF Tech ID 12B147
US Patent Pending

Open-Path/Free Space Optical Communication System Using Reflected or Back Scattered Light

This system is a free space optical (UV, visible, IR) communication system that is ideal for indoor and outdoor communication between two or more locations that can not “see” each other directly due to line-of-sight interfering objects.

USF Tech ID 00B069
US Patent 7,751,716

System and Method of Exploiting Location Awareness

A novel way of extracting major wireless channel statistics through absolute location information and digital topographical data. The location information and topographical data combine to work together to improve the performance and efficiency of wireless cognitive radio by delivering more precise and accurate statistical information to the cognitive engine.

USF Tech ID 07A006
US Patent 8,295,859

Contact us: 3802 Spectrum Blvd., Suite 100 Tampa, FL 33612 - 813.974.0994 patents@research.usf.edu | http://www.research.usf.edu/pl
Automatic Selection of Optimal Local Communication Channel from a Plurality of Channels

Method of selecting the channel with lowest energy consumption that also meets a specific performance threshold. For a PC that has both Ethernet and Wi-Fi interfaces, this invention would automatically test for link bottlenecks and then select either Wi-Fi or Ethernet in such a manner as to reduce energy use. For a smart phone with both Wi-Fi and cellular data service, this invention would optimally select either Wi-Fi or cellular data service. This invention will be very useful in environments where energy is scarce, costly, or experiences data rate fluctuation.

USF Tech ID 12A001
US Patent Pending

Digital Coding Scheme for Data Transmission

A novel technology that combines the two widely used approaches of Direct Sequence Spread Spectrum (DSSS) and Turbo coding. By combining these two technologies iteratively, decoding can take place between the DSSS block and the Turbo decoder. As a result, the overhead required to carry the turbo code information is drastically reduced, allowing for a much greater bandwidth for a given bit error rate (BER) at the receiver.

USF Tech ID 08A014
US Patent 8,295,326

Cognitive Radio Transceiver for Dispersed Spectrum Utilization

Invention is based on transmitting the information over multiple dispersed bands in contrast to transmitting the signal over a single band. A cognitive radio transceiver is developed for the implementation of dispersed spectrum utilization technique. In addition, an equation that facilitates the relationship between the conventional whole spectrum utilization and the invented dispersed spectrum utilization is derived. The results show improved performance of systems that can potentially increase revenue for wireless service providers.

USF Tech ID 08A009
US Patent 8,064,836

Open Path Laser /Optical Communication Systems and Methods utilizing Wavelengths between Atmospheric and Gaseous Absorption Lines

A multi-channel optical communication technique using laser or optically generated beams through the atmosphere which is cheap, provides channel isolation, thereby preventing cross-talk between adjacent wavelength channels, and does not require fine tuning.

USF Tech ID 00B077
US Patent 7,646,987 and 7,126,971
Adjacent Channel Interference (ACI) Suppression and Rejection in OFDM-based Communication Systems

The present invention considers designing per subcarrier windowing design based on prolate-spheroidal-functions to maximally utilize the available spectral guard band for individual subcarriers while suppressing the ACI at the transmitter, and rejecting the ACI at the receiver. The present invention enables improvements to multicarrier communication systems, by offering maximum ACI suppression at the transmitter and receiver side that are used in various data demanding applications in wireless and personal communications.

USF Tech ID 13A065
US Patent Pending

Channel-based Coding for Wireless Communication

An advanced novel transmission scheme based on channel pre-coding and adaptive antenna subset selection in MISO wireless systems for highly secure and resilient communication links between the legitimate transmitter and receiver. In addition, by combining the channel hopping scheme with the frequency hopping-based pre-coding, they have achieved resilience against jamming attacks.

USF Tech ID 14A018
US Patent Pending

User-specific QoS Scheduling for Wireless Systems

User-specific Quality-of-Service (QoS) scheduling which can improve the number of supportable users by incorporating user-specific QoS requirements, while maintaining an acceptable Mean Opinion Score (MOS) level. Furthermore, when targeted to maximize spectrum utilization and combined with voice codecs matched to the auditory characteristics of users, higher system capacity may be achieved. Simulation and analytical research show that user-specific QoS study can be a very promising research field to improving the quality, capacity, and performance of the wireless systems.

USF Tech ID 14B108
US Patent Pending

Edge Windowing and Asymmetrical Windowing Function for OFDM based Systems

A side lobe suppression method for edge windowing of OFDM systems to limit interference of adjacent bands. This involves windowing the subcarriers on the edges of the OFDM symbols because they have a larger effect on the side lobes than the inner subcarriers located in the middle of the band. By utilizing proper scheduling of the subcarriers and exploiting the dependency of channel dispersive characteristics inter symbol interference (ISI) and inter carrier interference (ICI) can be reduced.

USF Tech ID 11A037
US Patent Pending
Piezoelectric Based Solar Cells

This technique employs piezoelectric material in the structure of the devices and modifies the energy barrier at the interface by using either external mechanical forces or initial stress in the layer. Modifying the energy barrier can enhance the charge transfer from the photoactive layer; henceforth, increasing the energy conversion efficiency in the solar cells.

USF Tech ID 15A036
US Patent Pending

All Spray See-Through Organic Solar Array
With Encapsulation

The transparent property of the solar modules created by this technique allows for application on windows and windshields. This new method is more efficient than silicon solar cells in artificial light environments and has the potential to be used on any type of substrate, including cloth and plastic. This expands their use in indoor applications. This technique targets large-scale, low cost manufacturing of commercial photovoltaic products based on solution of organic semiconductors.

USF Tech ID 13A016, 13A018 and 13A066
US Patent Pending

USF High Efficiency Reactor (USF-HER)

An innovative high efficiency reactor design for any process that requires multiple discrete reaction steps. This reactor can provide up to 82% volumetric footprint reduction compared to traditional reactor designs, reducing construction and operational costs associated with the process. USF-HER can be effective under any operational conditions where space is a constraint or high efficiency reactions are desired.

USF Tech ID 14A032
US Patent Pending

Mini Notched Turbine Generator

This turbine can convert flow into electrical energy by using electromagnetic subsystems to transform the kinetic energy to electricity. The invention has applications in the field of wireless self-powered micro and nano devices.

USF Tech ID 13A068
US Patent Pending
<table>
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<th>Energy</th>
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<tr>
<td><strong>Immisciblizing A Target Protein for Applications in Bio-Photovoltaic and Bio-Sensing System</strong></td>
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<td>These are novel systems and methods for immobilizing target proteins on an underlying electrode for applications in bio-photovoltaic (bio-PV) and bio-sensor devices.</td>
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<td><strong>Variable Screening Apparatus for Selective Admittance of Light</strong></td>
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<td>This is a solar shading technology that uses the properties of flexible materials to form a screen that changes shape to create openings that vary in size according to desired needs. These novel shades are made from materials such as wood, metal, polymers, textiles, and composites. They have the ability to stretch, bend, and twist to adapt to lighting needs and passive energy strategies, as well as furthering the enrichment of architectural space.</td>
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<td><strong>USF Tech ID 09B074</strong></td>
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<td><strong>US Patent 8,960,259</strong></td>
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<td><strong>Integrated Desalination and Power Generation</strong></td>
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<td>This is a new method of desalinating sea water and producing power at the same time using low grade heat sources such as waste heat/solar energy. The system could also be used to treat concentrated brine such as shale gas mining frac water, and coal bed methane produced water. The system could be ideal for remote island fresh water and power generation from seawater applications.</td>
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<td><strong>USF Tech ID 11A071</strong></td>
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<td><strong>US Patent Pending</strong></td>
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<td><strong>System and Methods for Converting Carbon Dioxide into Chemical Feedstock</strong></td>
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<td>This is a new method for the management of carbon dioxide. This method may be implemented to reduce greenhouse gas emissions and turn carbon dioxide into useful feedstock.</td>
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<td><strong>USF Tech ID 12A026</strong></td>
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<td><strong>US Patent 8,999,283</strong></td>
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Removal of Heavy Metal Ions from Fluids Using Dendrimer-based Composite Materials

This is a novel method that can be used for the removal of heavy metal ions from fluids using dendrimer macromolecules as environmental metal chelators. This technology is applicable to many emerging industries which focus on the removal of heavy metals. It could be used in wastewater treatment plants, pharmaceutical industries, and environmental remediation.

USF Tech ID 12B151
US Patent Pending

Concentrating and Harvesting Mechanisms for Photo-Bio-Reactors

This is a novel passive mechanism for concentrating the culture using gravity settling and taking advantage of gases produced during cultivation for dewatering. This invention would regulate the release of gases to better control the dewatering. It also requires less energy and chemical inputs for downstream processing.

USF Tech ID 15B168

System and Method for Waste Water Treatment and Resource Recovery

This is an integrated direct-filtration (DF) system with AnMBR for treatment and energy recovery. This novel wastewater treatment and resource approach will transform wastewater management practices by enhancing throughput, decreasing the plant footprint, and reducing energy consumption.

USF Tech ID 15A027
US Patent Pending

Detecting the Presence of a Lead Contaminant

a novel lead detection system that comprises an infrared (IR) light source, detector, and a coupling device that is in communication with the light detector. The reflected signature of this light can be analyzed by the computing device to determine which lead contaminants, if any, are present on the surface. It is a fast, accurate, and simple test that can be carried out by any personnel.

USF Tech ID 14A092
US Patent Pending
The BullHorn

This is a device to compete in NASA’s Micro Gravity NExT Competition under the sampling device categories. This device meets both the surface and subsurface sampling requirements. The device can be used both manually or robotically.

**USF Tech ID 16B151**
US Patent Pending

Survey of Soil Surface

This invention provides a fast, contactless alternative Kelvin Probe to measure electric potential of the soil or soil filler surface. The probe can provide assessment of the corrosion condition of embedded metallic components such as soil reinforcement, and also serve to monitor cathodic protection in soils without disturbing the soil surface.

**USF Tech ID 16A021**
US Patent Pending

Recovery of Phosphorus from the Atmosphere Using A UV Light Tool for Phosphorus Sustainability and Removal

This invention uses UV light to photolyze atmospheric phosphine to phosphate inside a chamber. Water is used to recover the phosphorus from the chamber. The recovered phosphorus can be used in various agricultural industries including phosphate fertilizers.

**USF Tech ID 15B160**
US Patent Pending

Transparent Multi-Junction Organic Solar Module

This is a novel method and apparatus for fabricating an organic, polymer solar module with a tandem or multi-junction structure. This module uses conductive graphene as one or both electrodes and can be fabrication on rigid (e.g., glass) or flexible (e.g. PET) substrates.

**USF Tech ID 13B146**
US Patent Pending
Physical Layer Security for Wireless Implantable Medical Devices

This is a novel authentication mechanism between wireless implantable medical devices (IMDS) and wearable external devices (WEDs) to prevent adversaries attempting to maliciously control the IMD. Separately, WED always listens for pilot signal transmission out of its own request, it activates and sends a jamming signal to IMD, thereby preventing IMD from decoding the potential adversary’s signal.

USF Tech ID 15B112
US Patent Pending

Converter-Gating for Efficient and Secure Power Delivery

An on-chip power delivery technique that is concurrently power efficient and trustworthy against side-channel power analysis attacks. The converter-gating system adaptively turns on and off individual stages of an interleaved switched-capacitor voltage converter based on workload information to improve voltage conversion efficiency. Converter-gating is further utilized as a countermeasure against side channel power analysis attacks by pseudo-randomly controlling converter activity.

USF Tech ID 14A066
US Patent Pending

Authentication Using Multiple Devices

A first device requests access to a resource, after which the authenticator device can send a challenge (such as a QR code) to at least one other device associated with the user. The device that receives the challenge sends the challenge to the second device associated with the user. The second device sends a response to the authenticator device. The authenticator device compares the challenge sent and the response received to determine whether or not to authenticate the first device.

USF Tech ID 14A079
US Patent Pending

Design of Adiabatic Dynamic Differential Logic for DPA-Resistant Secure Integrated Circuits

This is a design of adiabatic dynamic differential logic for differential power analysis (DPA). This technology has a wide range of applications including virtually any cost sensitive secure integrated chips.

USF Tech ID 13B129
US Patent Pending
Multi-lobed, Cooled Teething Device

This is a multi-lobed teething device that can be periodically refilled with a cold liquid, thereby eliminating a requirement for the device to be placed in a cold environment for a predetermined period of time prior to each use. The detachable lobbed protrusion may be replaced with a pacifier to further increase the versatility of the teething device.

USF Tech ID 13A117
US Patent Pending

Modern Dice

This is a novel system of groves to act as a numbering system for each of the six sides of the die, creating a simple, clear and new look fit for a game piece in the modern era of the 21st century. The physicality of the grooves allow the user to not only see, but to feel the numbers, allowing for an advance in the accessibility of the interpretation of game pieces. This tactile feature also helps the visually impaired person to identify the numbers on die.

USF Tech ID 14A100
US Patent 9,415,298

Picture Hanging Dot

This is an alternative hanging system that utilizes the butterfly style dry-wall anchor combined with a monofilament. The novel invention removes the real apparatus altogether and allows for a nearly invisible hanging system which eliminates distractions to the display of art and the architecture that houses it. This system also has an extremely low cost due to its relative simplicity and can be installed in the ceiling or wall.

USF Tech ID 13B119
US Patent Pending

String Vibration Frequency Altering Shape

The application of this invention is in musical acoustics and might also help in force sensing through vibration analysis, such as using it as a strain gage or force sensor. A prototype device has been constructed to illustrate the concept of the musical kinetic shape. The prototype is controlled by a computer and can be easily programmed to rotate the kinetic shape into a desired position to produce specified and exact notes. By moving the platform and plucking the string, songs can be played using the unique and novel instrument.

USF Tech ID 13B175
US Patent 9,520,110
## Technology Index

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