Abstracts of Awards for Fiscal Year 2013 SBIR Program

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**FY 2013 Phase I Award**

**Topic:** [Cybersecurity](#book9_01)

**Subtopic:** Development of an SCAP Validation Tool with APIs

**Title:** Automated SCAP Tool Validator (ASTV)

**OU:** Information Technology Laboratory

**Firm:** ATC-NY  
33 Thornwood Dr., Suite 500  
Ithaca, NY 14850-1280

**Principal Investigator**: Robert Joyce  
**Phone:** 607-257-1975  
**Email:** rjoyce@atcorp.com

**Award Amount**: $89,920.00

**Abstract:** The current testing methods of the NIST Security Content Automation Protocol (SCAP) Validation Program are largely manual and labor-intensive, making comprehensive validation of SCAP-enabled IT security products difficult and time-consuming. ATC-NY will design and develop the Automated SCAP Tool Validator (ASTV) for use with the SCAP Public Validation Test Suite and others. ASTV automates the configuration of test systems, execution of test case content, and comparison of tool output to expected results. ASTV will provide a graphical front end and an API to ease integration with existing test workflows. By running multiple test cases concurrently in a distributed or cloud-based ASTV installation, thorough validation of SCAP tools will be dramatically faster than currently possible.

**Commercial Applications:** With the requirement for SCAP tools increasing due to government mandates and increasing security threats, ASTV will have a broad market. The DoD, for instance, has recently adopted SCAP standards in order to ensure systems are securely configured. Developers and users of SCAP-enable tools must ensure the correctness and standards-compliance of those tools. The target users are commercial IT security vendors that need to self-assert product support of SCAP capabilities, NVLAP-accredited laboratories as part of their form formal SCAP validation testing for NIST, enterprise users who may need to validate in-house SCAP tools, and end users that need to perform their own conformance testing of commercial SCAP products. ASTV will be available free to users as open-source software; ATC-NY will provide training, support, and integration/customization services.

**FY 2013 Phase I Award**

**Topic:** [Cybersecurity](#book9_01)

**Subtopic:** Bragg Grating Enhanced Narrowband Single Photon SPDC Source

**Title:** Bragg Grating Enhanced Narrowband Single Photon SPDC Source

**OU:** Information Technology Laboratory

**Firm:** Gener8 Inc.  
535 Del Rey Ave.  
Sunnyvale, CA 94085-3514

**Principal Investigator:** William Bischel **Phone:** 550-940-9898 **Email:** bbischel@gener8.net

**Award Amount**: $89,957.00

**Abstract:** Spontaneous Parametric Down conversion (SPDC) is currently an active research area in quantum communications (QC) to develop entangled single photon sources. However, the bandwidth of current SPDC sources is too broad for many applications. NIST researchers have modeled a solution to this problem that reduces the bandwidth by >50. We proposed to fabricate a prototype of the NIST device by developing an innovative fabrication method for a Bragg grating with a pi phase shift over the SPDC periodically poled waveguide in lithium niobate. The project goal is to demonstrate significant narrowing of the SPDC spectrum. We anticipate that the result of this Phase I project will be a design for a highly integrated SPDC source will enable new fundament QC research.

**Commercial Applications:** The development of a novel Bragg grating fabrication process that has a pi phase shift at the center is important for the development of many devices in addition to the SPDC application. For example, it can be used in the development of novel designs for new external cavity stabilized diode lasers. The SPDC single photon source proposed to be developed in Phase II will have significant market in the scientific community studying advanced quantum communications applications.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Flowing Water Optical Power Meter for Laser Measurements

**Title:** Flowing Water Optical Power Meter for Laser Measurements

**OU:** Physical Measurement Laboratory

**Firm:** High Precision Devices, Inc.  
1668 Valtec Ln., Ste C  
Boulder, CO 80301-4655

**Principal Investigator:** Joshua West **Phone:** 303-447-2558 **Email:** jwest@hpd-online.com

**Award Amount**: $90,000.00

**Abstract:** High Precision Devices, Inc. (HPD) proposes to use the Phase I SBIR as a vehicle to develop and market a commercially viable 25kW flowing water optical power meter (FWOPM) for industrial, research, and government applications. Building upon existing and fundamentally sound NIST design, and without sacrificing quality or accuracy, HPD will reduce costs and increase manufacturability using best practices for manufacturing, taking advantage of scale economies, and developing suitable alternatives for several time-intensive assembly and fabrication steps.

**Commercial Applications:**  The flowing water optical power meter head built in this Phase I SBIR will be specifically designed to provide a highly accurate primary standard for laser power measurements in the 500 W to 25 kW range. The market for high powered lasers for industrial, defense, research and other commercial applications is both significant and rapidly growing. The largest industrial segment, materials processing (e.g., metal cutting, welding and finishing), represented approximately $3.9 billion of global revenue in 2012. To the best of our knowledge, no commercially available SI-traceable measurement standards exist for the high power segment of the laser market.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Workflow Engine for Smart Manufacturing

**Title:** Smart Manufacturing Workflow Environment

**OU:** Engineering Laboratory

**Firm:** Nimbis Services Inc.  
1616 Anderson Rd.  
McLean, VA 22102

**Principal Investigator:** Brian Schott **Phone:** 443-2746064  
**Email:** brian.schott@nimbusservices.com

**Award Amount**: $90,000.00

**Abstract:** Nimbis in partnership with UCLA and Smart Manufacturing Leadership Coalition (SMLC) will provide an open workflow environment that supports the sequential execution of 3rd party APPS using net-worked information based modeling and data analytic technologies to integrate manufacturing intelligence across an entire manufacturing ecosystem. The SMWE leverages Nimbis commercial cloud technical analysis marketplace APP hosting infrastructure but now extending it to support multi-dimensional smart manufacturing modeling and real-time data driven process workflows that orchestrates the use of 3rd party supplied APPS and ISV application software providing management alternatives in the right context, at the right time, to the right user to optimize a plant operation.

**Commercial Applications:** The SMLC identified that by lowering the implementation barriers around cost, complexity, ease-of-use, measurement and computing availability, the U.S. manufacturing industry could deploy foundational infrastructure for vertically and horizontally oriented manufacturing intelligence to collectively strengthen capability. Creating an open manufacturing APP workflow environment hosted on a smart manufacturing platform will not only transform manufacturing but will also stimulate entrepreneurs to develop and license their IP in the form of models that can be plugged into the platform.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Highly Multiplexed Spectroscopic Ellipsometer for In-line Process Control

**Title:** High Speed Imaging Spectropolarimeter for Dynamic Samples

**OU:** Material Measurement Laboratory

**Firm:** Polaris Sensor Technologies, Inc.  
200 Westside Square, Suite 320  
Huntsville, AL 35801

**Principal Investigator:** Art Lompado  
**Phone:** 256-562-0087 **Email:** art.lompado@polarissensor.com

**Award Amount**: $89,973.00

**Abstract:** Spectroscopic ellipsometry is recognized as the gold standard in noncontact characterization of the refractive index and thickness of a thin optical film or film stack on a substrate. However, it suffers from a number of shortcomings, perhaps the most important of which is the time required to perform a single measurement. Moreover, manufacturers are interested in comprehensive evaluation of thin films over a number of dimensional parameters including time, space, and wavelength, aspirations that cannot be achieved with existing devices. Polaris Sensor Technologies proposes to overcome these shortcomings through the design of an integrated spectroscopic polarimeter capable of performing measurements over all of these dimensions at high repetition rates. The proposed device integrates the established polarimetric architectures of division of aperture, focal plane, and time to yield multiplexed data collection method that simultaneously characterizes samples across all relevant dimensions. A unique sensor calibration procedure is proposed along with a strategy to apply this procedure for highly accurate thin film characterizations. This approach in conjunction with proposed dedicated data processing hardware, promises to overcome current ellipsometric limitations and open up the technique to larger application spaces, including the rapidly developing markets of thin film process control.

**Commercial Applications:** Applications include quality control monitoring of deposited films in a roll-to-roll manufacturing process. Fabrication of flexible electronic and printed organic photovoltaic devices, with their inherently thin substrates, are specific examples of manufacturing processes whose quality control monitoring would benefit immensely from a high speed spectro-ellipsometric imager.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Three-Dimensional Test Materials for Solid Supports

**Title:** Three-Dimensional Test Materials for Solid Supports

**OU:** Physical Measurement Laboratory

**Firm:** Prime Synthesis  
2 New Rd., Suite 126  
Aston, PA 19014

**Principal Investigator:** Dianne Rothstein **Phone:** 610-558-5920 **Email:** dmrothstein@primesynthesis.com

**Award Amount:** $90,000.00

**Abstract:** Since 1990, Prime Synthesis, Inc. (PSI) has been a leading manufacturer of controlled pore glass (CPG). It has developed significant expertise in the optimization of physical characteristics and chemical modifications of CPG for a variety of applications. CPG has a unique combination of attributes including a very uniform, three-dimensional, nanopore structure that is dimensionally stable in organic solvents and has excellent mass transfer characteristics. It is also very rigid for good mechanical stability, and its manufacture is highly scalable. However, due to its surface chemistry, the density and distribution of sites for chemical attachment can limit its applications. PSI has developed a novel next generation oligonucleotide synthesis support (HybridCPG), based on a nano-thick coated CPG, that has dramatically improved chemical loading capabilities, but retains CPG’s other favorable characteristics. A series of HybridCPG samples with varying pore sizes and derivitized with suitable molecules or nano-particles would serve as excellent standard materials for the proposed NIST characterization, and are well within the technical capabilities of PSI. The proposed structural studies would be of great value in developing a family of HybridCPG products that could dramatically reduce the manufacturing costs of several important classes of advanced pharmaceuticals and fine chemicals.

**Commercial Applications:** PSI currently makes and sells CPG solid supports for synthesizing oligonucleotides. Its customers include international genetics researchers, pharmaceutical companies and contract manufactures of oligonucleotide-based drugs and medical diagnostic kits. HybridCPG can provide improved synthesis yields and purities for more economical oligonucleotide production. This will make such emerging new oligonucleotide-based products more competitive and encourage the development of additional products.

Antibody purification media is another very large market for conventional CPG. Affinity chromatography is widely used for the purification of monoclonal antibodies (mAb’s). These represent a very important and successful class of drugs, many for the treatment of cancer. The production rate of mAb’s is limited by downstream purification steps. A version of HybridCPG could be developed with higher dynamic binding capacities and better scalability, to minimize this bottleneck in mAb manufacturing.

A variation of HybridCPG could yield a family of enhanced immobilized enzyme products. These represent a popular way of increasing bio-reactor output and specificity. This technology could provide a cost-effective alternative for chemical manufacture of foods, drugs and biofuels. The NIST studies of HybridCPG samples would facilitate the development of the above advanced products, yielding annual sales of over $200 million within five years of product introductions.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Angularly Sensitive Detectors for Transmission Scanning Electron Microscopy

**Title:** Digital Micromirror Device Detection Scheme for Transmission Scanning Electron Microscopy

**OU:** Material Measurement Laboratory

**Firm:** RadiaBeam Technologies LLC  
1717 Stewart St.  
Santa Monica, CA 90404

**Principal Investigator:** Bryce Jacobson  
**Phone:** 310-822-5845 **Email:** jacobson@radiabeam.com

**Award Amount:** $89,642.30

**Abstract:** Accurate quantitative characterization of materials is crucial for a wide range of industrial and research applications. New transmission scanning electron microscopy (t-SEM) methods have the potential for high-resolution imaging similar to transmission electron microscopy (TEM) with a less expensive, faster, and more widely available SEM system. To exploit the full potential of these imaging techniques, a more specialized detector is required. The novel detection system proposed will utilize a digital micromirror device for achieving precise selection of any combination of small angular portions over a large area of the diffraction plane and will easily transition between the production of bright field and dark field images and transmission diffraction patterns.

**Commercial Applications:** The demand for effective nanoscale material characterization is steadily growing, in large part due to the increasing need for accurate failure analysis across a wide range of industries. As a result of this demand, the global market for electron microscopes is expected to surpass $4.3 billion USD in annual sales by the year 2017, with SEM comprising the largest portion of this market. SEMs are about four times more common in the private sector than in public research institutions and universities. Therefore a likely potential customer for our detector would be a manufacturing company looking to upgrade the detector system on its SEM in order to achieve better material characterization. Industries utilizing these microscopy methods include manufacturers of semiconductors, steel, chemistry, automobiles, cosmetics, pharmaceuticals, and electronics.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Advanced Tactile Sensing Technology for Robotic Hands

**Title:** Advanced Tactile Sensing for Dexterous Robot Hands in Industrial Automation and Assembly

**OU:** Engineering Laboratory

**Firm:** SynTouch, LLC  
222 South Figueroa St.   
Los Angeles, CA 90007-6601

**Principal Investigator:** Jeremy Fishel  
**Phone:** 213-973-4102 **Email:** jeremy.fischel@SynTouchLLC.com

**Award Amount:** $89,989.00

**Abstract:** Robotic actuators exceed human speed, accuracy, and strength, but human hands are regarded as the ultimate in dexterity. SynTouch proposes this is due absent human-like tactile sensing and intelligent reflexive behaviors in robots. SynTouch created a multimodal compliant tactile sensor that mimics the sensory ability of the human fingertip (force, vibration and temperature) and algorithms that fill this absence. In this research, we will perform integration of the BioTac with the Schunk Dexterous Hand (SDH). Working with NIST and industrial partners, SynTouch will develop measures of robotic grasper dexterity and use them to evaluate new tactile sensory technology with the older tactile sensors of the SDH. The biomimetic nature of the BioTac and biologically-inspired reflexive behaviors will lead to a new level of dexterity, enabling advanced applications in industrial automation and assembly.

**Commercial Applications:** Since early beginnings within the automotive industry, the market for robots has continued on a rapid growth trajectory. As the concept of mass production slowly gives way to a mass customization model and robots are employed for a wider variety of functions, robots need to adapt to environments in which tasks are continually changing. And, they need to be able to incorporate these changes with minimal tooling requirements in order to maintain desired efficiencies. SynTouch has proposed a technology to meet these needs. The use of tactile sensing in robotic applications is not only anticipated to improve robotic dexterity, but this necessary feedback mechanism permits for the reduction in precision requirements of robotic arms and thusly present a substantial cost savings to the end user.

**FY 2013 Phase I Award**

**Topic:** Manufacturing

**Subtopic:** Electronics System for Microscale Thermogravimetric Nanoparticle Analysis

**Title:** High-Sensitivity, Low-Cost, Surface-Acoustic-Wave Based Microscale Thermogravimetric Analyzer for Nanoparticle Characterization

**OU:** Material Measurement Laboratory

**Firm:** X-wave Innovations, Inc.  
407 Upshire Circle  
Gaithersburg, MD 20878

**Principal Investigator:** Dan Xiang **Phone:** 301-948-8351 **Email:** dxiang@x-waveinnovations.co**m**

**Award Amount:** $89,999.00

**Abstract:** To meet NIST’s need for development of a new electronic system for microscale thermogravimeter nanoparticle analysis, X-wave Innovations, Inc. (XII) proposes a high-sensitivity, high-accuracy, low-cost, surface-acoustic-wave based microscale thermogravimetric analyzer (SAW-µ-TGA). The proposed approach is based on XII-developed surface acoustic wave (SAW) sensor technology, which is capable of simultaneously providing accurate temperature and mass change measurements at elevated temperatures beyond the required 700°C in real time. The success of the proposed effort will result in not only a novel SAW-µ-TGA technology, but also a system that is inexpensive, accurate, fast, and easy to use for industrial product analysis in manufacturing environments.

**Commercial Applications:** The proposedSAW-µ-TGA offers a new µ-TGA platform with significantly higher temperature limit and lower temperature interference than QCM based µ-TGA. The success of the SAW-µ-TGA development will crack the huge potential market in the nano-material manufacturing industry. This market potential will increase in the future with the advance of the nano-science, engineering and manufacturing, which is fueled by the increasing demands for high performance electrical and mechanical systems. The developed SAW-µ-TGA technology can be easily converted to a generic nano-material characterization instrument and high sensitive sensor systems, such as the chemical-biological agent detectors. This could open up other market opportunities for the developed SAW-µ-TGA technology. Thus, the market potential for this new technology is tremendous.

**FY 2013 Phase II Award**

**Topic:** Information Technology and Cybersecurity

**Subtopic:** WS-BiometricDevices (WS-BD) Conformant Handheld Fingerprint Sensor

**Title:** WS-BD Conformant Handheld Multi-biometric Acquisition System   
 **OU:** Information Technology Laboratory

**Firm:** Fulcrum Biometrics, LLC  
1862 W. Bitters Rd. #100  
San Antonio, TX 78248-1825

**Principal Investigator:** Matt Osborne **Phone:** 210-348-3687 **Email:** matt@fulcrumbiometrics.com

**Award Amount:** $300,000.00

**Abstract:** Secure trusted biometric validation of identity has never been more important. The increase in global terrorism, unfettered identity theft and new legislation requiring multi-factor authentication are a few of the driving factors. The biometrics industry has not actively responded to the changing market conditions being driven by the explosion in mobile computing. Millions of new mobile devices are rapidly replacing traditional computers in both commercial and public sector organizations. This project seeks to develop a new wireless multi-modal biometric acquisition systems that will deliver biometrics information securely over standard web services. Our objective is to build on Phase I and produce a hardware design and software package that is ready to enter into mass production.

**Commercial Applications:** The commercial application of this technology and research is immediately apparent considering the total lack of standards based wireless biometric acquisition devices in the market. The opportunities cut across both private and public sectors which are both experiencing tremendous changes as users rapidly adopt more affordable and portable computing devices. Examples of vertical markets (domestic and international) that can immediately take advantage of this technology if developed are: Law Enforcement, military, eGovernment, Mobile Workforce Management, Mobile Banking/Micro Finance and eHealth/Mobile Healthcare. As the trend towards adoption of fully wireless always connected devices grows nearly all traditional USB based biometric sensors will become obsolete and a new breed of wireless, intelligent biometric sensors will replace them.

**FY 2013 Phase II Award**

**Topic:** Manufacturing

**Subtopic:** Query-based Geometric Interoperability for Advanced Manufacturing

**Title:** Query-Based Interoperability for Simulation of Composite Structures

**OU:** Engineering Laboratory

**Firm:** Intact Solutions, LLC  
3734 Grandier Rd.  
Sun Prarie, WI 53590-9353

**Principal Investigator:** Michael Freytag **Phone:** 614-499-0120 **Email:** freytag@intact-solutions.com

**Award Amount:** $300,000.00

**Abstract:** We propose to design and implement a query-based approach to interoperable modeling and simulation of composite material structures, that usually contain the manufacturing recipe within their design. In Phase I, we established the feasibility of the approach using a demonstration scenario of CAD/CAE interoperability for assemblies. In Phase II, we propose to develop a series of use-case scenarios for modeling and simulation of as-manufactured material composite structures, and to develop commercial strength software that demonstrates the approach on an actual problem faced by US manufacturers.

**Commercial Applications:** The proposed approach differs fundamentally from the current, data-centric approach; it aims to dramatically broaden accessibility to and scope of simulation in advanced manufacturing, by providing fully interoperable software solutions. Specific commercial applications include fully automated integrated modeling and simulation of components and composite material structures, cloud-hosted simulation services, and advanced manufacturing applications delivered via SOA. The approach opens the arena for small, innovative companies offering new technology that can be integrated into the advanced manufacturing process chain, and lowers the barrier to their entry into the marketplace.

**FY 2013 Phase II Award**

**Topic:** Manufacturing

**Subtopic**: Non-contact Microwave Measurement of Electrical Properties of Nanofiber Materials

**Title:** Inline Material Electrical Characterization Sensor (IMECS)

**OU:** Material Measurement Laboratory

**Firm:** PaneraTech, Inc.  
2295 Village Crossing Rd., Ste 302  
Falls Church, VA 22043-2393

**Principal Investigator:** Yakup Bayram  
**Phone:** 614-429-1208 **Email:** yakup.bayram@paneratech.com

**Award Amount:** $299,972.00

**Abstract:** There is no capability to rapidly assess the electrical properties of nanofiber films during manufacturing and prepregging process. Continuous monitoring of these films will guide the U.S. nanofiber manufacturing industry in optimizing and increasing the yield rate with proper process optimization and avoid any inconsistency in the process and the cost with associated waste material. To address this technology gap in the U.S. manufacturing industry, PaneraTech, under the NIST SBIR Phase I program, demonstrated feasibility of an Inline Material Electrical Characterization Sensor (IMECS) for non-contact evaluation of nanofiber films during the manufacturing. Under this Phase II program, we will build a fully functional prototype, which will be ready for transitioning to the market.

**Commercial Applications:** PaneraTech’s IMECS offers significant benefits to the U.S, nanofiber manufacturing industry by determining real-time electrical compliance of specialty thin films, used in wide range of applications from aerospace to medical devices. This offers significant benefits to the manufacturers by identifying defective material early in the process and developing corrective course of action in the manufacturing process to avoid any inconsistency in the process and the cost associated with manufacturing waste material. Continuous monitoring of these films will also establish the statistical variation in the performance parameters of the nanofiber films and guide the U.S. nanofiber manufacturing industry in optimizing and increasing the yield rate with proper process improvement/optiminization. This will eventually result in significant savings and improved product quality for the manufacturers.

**FY 2013 Phase II Award**

**Topic:** Manufacturing

**Subtopic:** X-ray Chemical Shift Mapping for Industrial Materials Analysis

**Title:** Improved Microcalorimeter Detectors for X-ray Chemical Shift Mapping

**OU:** Physical Measurement Laboratory

**Firm:** STAR Cryoelectronics  
25-A Bisbee Court  
Santa Fe, NM 87508

**Principal Investigator:** Robin Cantor **Phone:** 505-424-6454 **Email:** rcantor@starcryo.com

**Award Amount:** $300,000.00

**Abstract:** X-ray fluorescence spectroscopy is a widely used and extremely sensitive analytical technique for qualitative and quantitative chemical analysis. Superconducting Transition Edge Sensor (TES) microcalorimeter detectors have now been developed that achieve an energy resolution of 2 eV for 1.5 keV X-rays, which is sufficient to enable the measurement of the small shift of the X-ray line position that occurs depending on the chemical bonding state of the fluoresced atoms. STAR Cryoelectronics proposes to fabricate improved TES detectors that match this performance and integrate these detectors into an X-ray spectrometer for chemical shift mapping. This will significantly enhance the power of X-ray spectroscopy as an analytical tool for a broad range of applications.

**Commercial Applications:** The primary commercial application for the proposed spectrometer with improved transition edge sensor (TES) microcalorimeter detectors is high resolution X-ray microanalysis for qualitative and quantitative chemical compositional analysis and chemical shift mapping. These analytical capabilities are extremely important for high technology industrial applications such as for semiconductor manufacturing as well as materials research.

**FY 2013 Phase II Award**

**Topic:** Manufacturing

**Subtopic:** High-Precision, Random Profile Roughness Specimens

**Title:** An Automated Lapping Apparatus and Process for High-Precision Random Profile Roughness Specimen Fabrication

**OU:** Physical Measurement Laboratory

**Firm:** X-wave Innovations, Inc.  
407 Upshire Circle  
Gaithersburg, MD 20878

**Principal Investigator:** Dan Xiang **Phone:** 301-948-8351 **Email:** dxiang@x-waveinnovations.com

**Award Amount:** $300,000.00

**Abstract:** The measurement and quality control for smooth engineering surfaces are becoming more and more important in modern science and technology due to their important engineering functions and high production costs. NIST has frequently received requests from U.S. industry to provide Standard Reference Material (SRM) high-precision, random profile roughness specimens to support smooth surface measurements. X-wave Innovations, Inc. (XII) proposes an automated lapping apparatus and process for fabricating the high-precision, random profile roughness specimens. The proposed apparatus and process possess advantages such as high manufacturing throughput, high reproducibility, and low operation cost. The success of this SBIR effort will result in an automated apparatus for manufacturing SRM high-precision, random profile roughness specimens for NIST to support U.S, manufacturing industry.

**Commercial Applications:** The quality control for smooth engineering surfaces becomes increasingly important, not only because of their important engineering functions, but also the high production costs. The market for the SRM High-Precision, Random Profile Roughness Specimens has been existing for a long time. This market potential will increase in the future along with the advance of the high-precision engineering and manufacturing, which is fueled by the increasing demands for high performance mechanical systems such as the propulsion systems for aerospace vehicles, medical devices, and nano-technologies. Not only do the high-precision random profile roughness specimens have huge market opportunities, but also the developed automated lapping apparatus itself. This is because the developed lapping apparatus can be easily converted to a generic surface material characterization instrument, such as a wear tester or source material analyser. This could open up other market opportunities for the develop apparatus and associated process.