Cybersecurity for Direct Digital Manufacturing

February 3, 2015
The National Institute of Standards and Technology

TENTATIVE AGENDA

8:30 am	**Arrive / Register**
9:00	**Welcome**

Celia Paulsen
IT Security Specialist, Computer Security Division

ITL Leadership

9:15   **Invited Talk**

Michael F. Molnar

Director, NIST Advanced Manufacturing Program Office
Director, Advanced Manufacturing National Program Office (AMNPO)

10:00	**Break**

10:15   ***An Analysis of Cyber Physical Vulnerabilities in Additive Manufacturing***

Christopher B. Williams

Associate Professor, Virginia Tech Department of Mechanical Engineering

The Additive Manufacturing (AM) process chain has unique vulnerabilities to cyber-physical attacks that warrant a detailed investigation due to their ability to fabricate parts in a layer-wise fashion. This presentation investigates potential attack vectors on the AM process chain, and details the results from an experiment in which the feasibility of a cyber-attack, and the ability of AM operators to detect the attack, was evaluated.

11:00   ***Applying and Assessing Cybersecurity Controls for Direct Digital Manufacturing Systems***

Scott Zimmerman, CISSP-ISSEP
Principal IT Advisor, Concurrent Technologies Corporation (CTC)

Dominick Glavach, CISSP, GCIH
Principle Fellow, Information Systems Security Engineer, CTC

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Cybersecurity for Direct Digital Manufacturing

Applying meaningful and assessing impactful cybersecurity controls are ongoing and significant challenges for the Direct Digital Manufacturing (DDM) Community. These issues will be significant as the technology moves into the mainstream manufacturing supply chain. This presentation will address cybersecurity threats to DDM, including insight into potential attack scenarios and motivations, gained through direct observations.

11:45	Lunch

12:45 pm   *Cybersecurity for Advanced Manufacturing – Securing the Digital Thread*

Dr. Michael F. McGrath
NDIA Manufacturing Division

Direct digital manufacturing is not inherently more vulnerable than other types of manufacturing, but it presents a very inviting target for would-be Intellectual property thieves or counterfeiters. This presentation offers several recommendations for enhancing protection of technical data in factory floor networks and in direct digital manufacturing systems in particular.

1:30   Panel: *Opportunities for Secure 3D Printing*

Robert Zollo (moderator)
President, Avante Technology

Dr. Claire Vishik
Trust and Security Technology and Policy Director, Intel Corporation

Andre Wegner
Founder, CEO at Authentize

This interactive panel will discuss cybersecurity risks for DDM and how various solutions can be applied. Panelists will talk about their perspectives of and approaches to protecting devices and information.

2:30   **Final Thoughts**

In this short interactive session, attendees will be asked for their thoughts and opinions regarding cybersecurity risks, challenges, potential solutions, and gaps where more research or technological solutions is needed. Anonymized responses will be collected and analyzed.

3:00	End of Symposium

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Biographies

(In Presentation Order)

Michael F. Molnar

Director, NIST Advanced Manufacturing Program Office
Director, Advanced Manufacturing National Program Office (AMNPO)

Mike Molnar likes to be introduced simply as "a manufacturing guy from industry" with nearly 30 years of experience in advanced manufacturing. To help provide an industry focus in 2011 he was named the first Chief Manufacturing Officer of the National Institute of Standards and Technology. Today Mike leads the NIST Advanced Manufacturing Program Office for extramural manufacturing programs and also serves as the director of the interagency Advanced Manufacturing National Program Office. As called for by the Advanced Manufacturing Partnership initiative, the AMNPO's mission is to foster industry-led partnerships and to form a "whole of government" approach to strengthen competitiveness and innovation in U.S. manufacturing.

Mike's experience includes leadership roles in advanced manufacturing, metrology, manufacturing systems, quality, technology development, sustainability and industrial energy efficiency. His credentials include service as a Federal Fellow in the White House Office of Science and Technology Policy, and election as Fellow of both the American Society of Mechanical Engineers and the Society of Manufacturing Engineers. He is a licensed Professional Engineer, a Certified Manufacturing Engineer and a Certified Energy Manager. He received a Master of Business Administration from the University of Notre Dame, and both a Master of Science in Manufacturing Systems Engineering and a Bachelor of Science in Mechanical Engineering from the University of Wisconsin. He is an active member of professional societies, consortia and volunteer organizations.

Christopher B. Williams

Associate Professor, Virginia Tech Department of Mechanical Engineering

Christopher B. Williams is an Associate Professor with a joint appointment with the Department of Mechanical Engineering and the Department of Engineering Education at Virginia Tech. He is the Director of the Design, Research, and Education for Additive Manufacturing Systems (DREAMS) Laboratory and Associate Director of the Macromolecules & Interfaces Institute. His research contributions have been recognized by six Best Paper awards at international design, manufacturing, and engineering education conferences. He is a recipient of a National Science Foundation CAREER Award (2013), the 2012 International Outstanding Young Researcher in Freeform and Additive Fabrication Award, and the 2010 Emerald Engineering Additive Manufacturing Outstanding Doctoral Research Award. Chris holds a Ph.D. and M.S. in Mechanical Engineering from the Georgia Institute of Technology (Atlanta, Georgia) and a B.S. with High Honors in Mechanical Engineering from the University of Florida (Gainesville, Florida).

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Scott Zimmerman CISSP-ISSEP
Principal IT Advisor, Concurrent Technologies Corporation (CTC)

Dominick Glavach CISSP, GCIH
Principle Fellow, Information Systems Security Engineer, CTC

Scott Zimmerman, CISSP-ISSEP is a Principal Technical Advisor at Concurrent Technologies Corporation with 20 plus years of Cyber Security experience. Mr. Zimmerman specialized expertise includes cyber security, cloud/mobile computing and systems engineering. Mr. Zimmerman's education includes a BS in Management Information Systems and AS in Electronic/Computer Technology. He is a Certified Information Systems Security Professional (CISSP); Information Systems Security Engineering Professional (ISSEP).

Mr. Glavach is a Principle Information Systems (IS) Security Engineer and CISO at Concurrent Technologies Corporation (CTC). He serves as the Cyber Security technical lead in CTC's Enterprise Infrastructure, provides CTC's clients with Cyber technical leadership and Subject Matter Expertise (SME). Mr. Glavach received his BS in Computer Science from the Indiana University of Pennsylvania, is a Certified Information System Security Professional (CISSP), an active member of the Information Assurance Technology Analysis Center SME Program and member of the Cloud Security Alliance (CSA).

The speakers specialize in cyber attack methods, attack warning and detection, and cyber countermeasures. They have presented numerous talks on cloud forensics, cyber adversaries and advanced persistent threats to a wide range of public and government audiences.

Concurrent Technologies Corporation (CTC) is an independent, nonprofit, applied scientific research and development professional services organization providing innovative management and technology-based solutions to government and industry. Established in 1987, CTC operates from more than 50 locations with a staff of over 1,400 employees. As a nonprofit 501(c)(3) organization, CTC's primary purpose and programs are to undertake applied scientific research and development activities that serve the public interest. We conduct impartial, in-depth assessments and technical evaluations that emphasize increased quality, enhanced effectiveness, and rapid technology transition and deployment. CTC offers a broad range of services and capabilities, coupled with real-world experience. For more information about CTC, visit www.ctc.com.

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Dr. Michael McGrath
NDIA Manufacturing Division

Michael McGrath is an independent consultant who provides analytic support for government and industry technology programs. He is also a Senior Technical Advisor (and former Vice President) at Analytic Services Inc. (ANSER), a not-for-profit government services organization. He previously served as the Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation (DASN(RDT&E)), where he was a strong proponent for improvements in technology transition, modeling and simulation, and test and evaluation. In prior positions, he served as Vice President for Government Business at the Sarnoff Corporation, ADUSD for Dual Use and Commercial Programs in the Office of the Secretary of Defense (OSD), Assistant Director for Manufacturing at the Defense Systems Research Projects Agency (DARPA-DSO), and Director of the DoD Computer-aided Acquisition and Logistics Support (CALS) program. While at DARPA, he managed the Affordable Multi-Missile Manufacturing Program and the Agile Manufacturing program. He was also heavily involved in DARPA's dual-use Technology Reinvestment Project and has been a strong advocate for defense use of commercial technology advances. His early government career included positions in Logistics Management at Naval Air Systems Command and in Acquisition Management in OSD. He is a Senior Fellow at the Potomac Institute for Policy Studies, a director of South Carolina Research Authority Applied R&D, and a member of the National Research Council's Materials and Manufacturing Board, the Defense Materials, Manufacturing and Infrastructure Committee (chair), the Penn State ARL Materials and Manufacturing Advisory Board, and the Georgia Tech Manufacturing Institute Advisory Board.

Dr. McGrath holds a BS in Space Science and Applied Physics and an MS in Aerospace Engineering from Catholic University, and a doctorate in Operations Research from George Washington University.

Robert Zollo
President, Avante Technology, LLC

Mr. Zollo is President and Founder of Avante Technology, LLC, a privately held company that develops, markets and licenses advanced 3D printing technology to 3D printer OEM, manufacturers and engineering firms. Prior to that he was President and Founder of Software Architects, Inc. a developer of electronic systems for OEM in a variety of industries, including 3D printing, digital imaging and optical recording. As Chairman of the Optical Storage Technology Association, Mr. Zollo was responsible for the development of ISO 13346, the international standard that defines the digital file format used in all DVD's, Blu-ray discs, CAT scan, MRI and digital X-ray systems. He also led the development of four patents relating to digital file management, image manipulation and file interoperability, and is the inventor of a patent pending method for controlling the printing of new engineering grade composite materials in FDM printers. Mr. Zollo holds a Bachelor of Science degree in Engineering from the US Military Academy at West Point, an MBA from Southern Illinois University and conducted his graduate technical studies at the University of Southern California's school of engineering. He is currently working on enhancements to the new ISO AMF standard defining the 3D file description language for additive manufacturing applications.

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Dr. Claire Vishik
Trust and Security Technology and Policy Director, Intel Corporation

Dr. Claire Vishik's work at Intel Corporation focuses on hardware security, Trusted Computing, privacy enhancing technologies, some aspects of cryptography and related policy issues. Claire is a member of the Permanent Stakeholders Group (Advisory Board) of ENISA, the European Network and Information Security Agency. She is an advisor to a number of cybersecurity R&D and policy projects, initiatives, and organizations, including the cryptography program at the University of Bristol or Oxford Cybersecurity Center for Capacity Building and is on the leadership teams of several organizations and initiatives tasked with the development of R&D strategies in cybersecurity in the US, Europe, and beyond. Claire is active in standards development and is on the Board of Directors of the Trusted Computing Group and on the Council of the Information Security Forum. Claire received her PhD from the University of Texas at Austin. Prior to joining Intel, Claire worked at Schlumberger Laboratory for Computer Science and AT&T Laboratories. Claire is the author of numerous papers and reports and an inventor on 30+ pending and granted US patents.

Andre Wegner
Co-founder & CEO, Authentise

Andre Wegner is co-founder and CEO of Authentise (www.authentise.com), the licensing and services platform for Distributed Manufacturing. Authentise secure streaming and quality assurance technology for 3D printing enables design owners to share their digital manufacturing designs with confidence, and get paid per print. Authentise Consulting also assists Fortune 100 corporations put 3D printing at the heart for their business. He is a frequent speaker on emerging intellectual property issues in 3D Printing and opportunities of distributed manufacturing at events such as Singularity University, Rapid, Designer of Things, Inside 3D Printing, 3D Print Show, Pacific Crest & WIRED. He has been quoted in publications such as BBC News, MIT Tech Review, Chicago Tribune, and Bloomberg. Prior to founding Authentise he managed a venture capital fund in Nigeria and advisory services in India. He is a graduate of St. Andrews University (UK), ESSEC (France) and Singularity University (California).

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