Training Summit Presentation Abstracts

DAU South Region 7115 Old Madison Pike, Huntsville, AL 35806

November 8th & 9th, 2017

Day	Time	Room	Ses #	Ses Name	Presenter	Title	Abstract
1	0900-1030	9	A1	DAU Tutorial	**Dr. Mark S. Phillips**	**Risk Based Process Audits**	Government Contact Quality Assurance (GCQA) has relied on appraisal methods for acceptance. This presentation will look at the historic methods of GCQA and frame Risk Based Process Audits as an alternative to tradition appraisal methods.
1	0900-1030	11	B1	RCM Tutorial	**David Sada & Chris Rooksberry**	**RCM Terminology and Concepts Workshop Part 1**	Reliability Centered Maintenance (RCM) provides the optimum Preventive Maintenance strategy for equipment availability and safety at lowest possible cost. This workshop is designed to provide an introduction to the RCM process, its terminology and concepts. The workshop will provide the history of RCM and discuss the current DoD RCM Policy as well as various implementation options. Additional workshop topics will include an overview of RCM Decision logic, Failure Modes and Effects Analysis (FMECA), types of Preventive Maintenance tasks, and RCM sustainment. It will also provide a discussion of the expected benefits and common pitfalls. The workshop will provide RCM Case studies and examples of previously executed programs. The workshop is intended for anyone interested in performing RCM analysis. Additionally the workshop can assist managers and decision makers gain an understanding of what RCM is, what it can accomplish and what it takes to implement the process.
1	0900-1030	5	C1	NASA/ Industry	**Dr. Fayssal Safie**	**Overview of Reliability Engineering Tools and Techniques**	This tutorial is intended to provide a better understanding of reliability engineering as a discipline with focus on the reliability engineering tools and techniques commonly used by engineering professionals throughout Government and industry. The tutorial also includes the application of these tools and techniques in technical assessments and special studies. The material in this tutorial is based on over 30 years of extensive industry and Government experience in reliability engineering and risk assessment.
1	0900-1030	3	D1a	Data Analytics	**Dan Wade & Andrew Wilson**	**Using Data Science for Aviation by Examining the Trade Space between Maintenance Optimization and Safety**	The Aviation Engineering Directorate is investigating the use of machine-learning based diagnostics and prognostics to inform maintenance decisions on and off-board aircraft. With this new technology comes significant power to learn from aircraft data, but it also opens up new avenues for unknown algorithm behavior. This talk will: give background on how the project was started, offer a method for applying batch learning techniques to aircraft data, focus on the problems of overfitting and generalization, and describe how the balance of algorithm error can be measured.
1	0900-1030	3	D1b	Data Analytics	**Nathon Rigoni**	**Machine Learning in Records Evaluation**	This will be a presentation and discussion of the uses of machine learning in classification of text based entries in order to achieve a transformation of data exhaust into reliability data. Other applications such as data modeling and characterization will be discussed as well as some basic principles of machine learning.
1	1100-1230	9	A2	DAU Tutorial	**Albert (Al) Barnes**	**Reliability growth**	Reliability Growth (RG) has been a high visibility requirement for DOD acquisition programs for more than ten years now. Yet, RG is still not well understood by many of the typical DOD acquisition program's stakeholders. RG done correctly requires significant resources of time, funding and dedicated test articles. RG also requires a well-defined/understood concept of operations and operational environment. This presentation will provide program stakeholders with the fundamentals of RG as well as links to freely available references and planning/tracking tools.
1	1100-1230	11	B2	RCM Tutorial	**David Sada & Chris Rooksberry**	**RCM Terminology and Concepts Workshop Part 2**	Part Two, See Session A2 for Abstract

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1	1100-1230	5	C2a	NASA/ Industry	**Christy Hales**	**Bird Strike Risk for Space Launch Vehicles**	Within seconds after liftoff of the Space Shuttle during mission STS-114, a turkey vulture impacted the vehicle's external tank. The contact caused no apparent damage to the shuttle, but the incident led NASA to consider the potential consequences of bird strikes during a shuttle launch. The environment at Kennedy Space Center provides unique bird strike challenges due to the Merritt Island National Wildlife Refuge and the Atlantic Flyway bird migration routes. This presentation will outline an approach for estimating risk resulting from bird strikes to space launch vehicles. The migration routes, types of birds present, altitudes of those birds, exposed area of the launch vehicle, and its capability to withstand impacts all affect the risk due to bird strike. Lessons learned, challenges over lack of data, and significant risk contributors will be discussed.
1	1100-1230	5	C2b	NASA/ Industry	**Frank Hark**	**Mil-HDBK-338 Environmental Conversion Table Corrections**	In reliability analysis for space launch vehicles, limited data is frequently a challenge due to the pure number of launches. A common solution is to use surrogate historical data of similar components from other industries (military data). The operating environment of the common data may be different from that of the necessary target analysis. The military electronic design handbook (MIL-HDBK-338) has a table for converting Mean Time Between Failure (MTBF) data from one environment to another. However, the table has some discrepancies and rounding of complementary conversions; namely going from environment A to B does not given the same result as going from B to A. This presentation will show the discrepancies in the original conversation table, the greater than expected magnitude, the problem with the updated published table and a suggested corrected table to reference when doing MTBF data environment conversion.
1	1100-1230	5	C2c	NASA/ Industry	**Holly Dinkel**	**Assessment of Launch Failures from 1989-Present**	Rocketry is inherently complex, hazardous, and at the vanguard of technology. Over the past three decades and after 2,300 orbital flights, the world has seen little reduction in launch risk with the privatization and international expansion of space exploration; in some nations, the probability of launch failure is increasing. Tendencies in global and national launch and failure rates, evidence of driving risk contributions from launch vehicle subsystem failures, and forecasting future launch failure probability are important facets of risk evaluation as many organizations develop launch capability. This presentation examines publicly-available failure records compiled for orbital launches by nation from 1989 through September 2017. Analysis emphasizes American and Russian launch trends and failures by critical subsystems. Data forecasting methodology predicts launch vehicle reliability to 2030. The data suggest dramatic improvements in launch reliability would require modifications to vehicle design.
1	1100-1230	5	C2d	NASA/ Industry	**Becky Green**	**An Overview of Solid Rockets**	Solid rockets are of interest to the space program because they are commonly used as strap-on boosters and can greatly increase the payload capacity of space launch vehicles. Solid rockets provide the additional thrust needed for the space launch vehicle to escape the gravitational pull of the Earth. Larger, more advanced solid rockets allow for space launch vehicles with larger payload capacities, enabling mankind to reach new depths of space. This presentation will discuss, in detail, the history of solid rockets. It starts with the invention of the solid rocket, and describes when, where, and how the first solid rocket was created. It then goes into the early uses and design of the solid rocket. The evolution of solid rockets is depicted by a description of how solid rockets evolved and were used throughout the 16th, 17th, 18th, and 19th centuries. Modern uses of the solid rocket include the Solid Rocket Boosters (SRBs) on the Space Shuttle and the solid rockets used on current space launch vehicles. The functions and design of the SRB and the advancements in solid rocket technology since the use of the SRB are discussed as well. Common failure modes and design difficulties are also discussed.

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1	1100-1230	3	D2a	Reliability	**Tim Willis**	**Using RIMFIRE to Enhance DA2410 Component Failure Analysis**	In order to improve the reliability of a system using traditional reliability engineering practices, the data collected must satisfy the requirements of established Reliability Engineering practices. Currently, the DA Form 2410 is the Army's primary source of maintenance, installation, removal and failure data of many aviation components. This analysis demonstrates additional data to what is available on the DA Form 2410 is required for reliability analysis of Army Aviation components. The analysis uses RIMFIRE (Reliability Improvement through Failure Identification and REporting) data to score usability of DA Form 2410 data for reliability analysis. This analysis demonstrates that for the purposes of reliability engineering, the DA Form 2410 data provides some pertinent information, but is otherwise insufficient. It also serves as an explanation as to how data from the RIMFIRE program in addition to the DA Form 2410 is used to fulfill requirements for reliability improvement of Army Aviation systems and components.
1	1100-1230	3	D2b	Reliability	**Seth Farrington**	**Reliability Modeling**	This presentation provides an overview of the development of a comprehensive RAM model and simulation for the US Army's aviation fleet. The model is a probabilistic characterization of the reliability of individual components, sub-systems, and entire aircraft based on historic data. The simulation is a predictive stochastic simulation to predict the availability and identify maintainability issues over future usage.
1	1330-1500	9	A3	DAU Tutorial	**Robert Dunn**	**Three-phase Quality Control used for Construction**	DoD Construction Quality Management – Quality management on DoD construction projects is key to the Government getting quality projects completed on time and within budget. This presentation will discuss the DoD's Construction Quality Management approach. This includes discussion of contractor's and Government's responsibilities to provide overall quality management for construction projects. In addition, will discuss the Three Phase Quality Control Inspection System.
1	1330-1500	11	B3	RCM Tutorial	**Jason Smith & Ron Dalton**	**RCM/CBM/MSG**	This briefing will cover US Army Reliability-Centered Maintenance (RCM) with focus on its history, policy, Army implementation, Army developed RCM tools and real-world examples.
1	1330-1500	5	C3a	NASA/Industry	**Aaron Young**	**Lost in Translation: The Case for Integrated Testing**	The building of a spacecraft is complex and often involves multiple suppliers and companies that have their own designs and processes. Standards have been developed across the industries to reduce the chances for critical flight errors at the system level, but the spacecraft is still vulnerable to the introduction of critical errors during integration of these systems. Most programs have a test plan in place that is intended to catch these errors, but it is not uncommon for schedule and cost stress to result in less testing than initially planned. Therefore, integrated testing, or "testing as you fly", is essential as a final check on the design and assembly to catch any errors prior to the mission. This presentation will outline the unique benefits of integrated testing by catching critical flight errors that can otherwise go undetected. Lessons learned and challenges over ownership will be discussed.

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1	1330-1500	5	C3b	NASA/Industry	**Adam Harden**	**Can There Be Too Much Redundancy?**	Systems that perform critical safety functions typically incorporate redundancy to improve system reliability. One would think that to best protect a critical safety function would be to incorporate as much redundancy in the design of the system as possible. It would seem obvious that by increasing the number of redundant trains would also increase the reliability by a factor equal to the number of redundant trains incorporated. Or does it? The aerospace industry often has limitations on space, weight, cost, and schedule, therefore a better understanding of the impact redundancy has on reliability can result in more appropriate design decisions. This presentation will focus on how adjusting redundant trains to a system will change the reliability of the system, and will show that the returns on reliability become diminished with each added train. This is illustrated with communication lines on a space launch vehicle that sends data between remote terminals and the vehicle's computer. This presentation will explain common measures of centrality and dispersion; and—with examples—will provide guidelines for how they may be estimated to ensure effective technical contributions to decision-making.
1	1330-1500	5	C3c	NASA/Industry	**Paul Britton**	**Lognormal Uncertainty Estimates for Failure Rates**	Quantitative results for aerospace engineering problems are influenced by many sources of uncertainty. Uncertainty analysis aims to make a technical contribution to decision-making through the quantification of uncertainties in the relevant variables as well as through the propagation of these uncertainties up to the result. Uncertainty can be thought of as a measure of the 'goodness' of a result and is typically represented as statistical dispersion. This presentation will explain common measures of centrality and dispersion; and with examples, will provide guidelines for how they may be estimated to ensure effective technical contributions to decision-making.
1	1330-1500	5	C3d	NASA/Industry	**Mo Al Hassan**	**FPGA Reliability Analysis for Launch Vehicle Reliability Block Diagrams**	Field Programmable Gate Arrays (FPGAs) integrated circuits (IC) are one of the key electronic components in today's sophisticated launch and space vehicle complex avionic systems, largely due to their superb reprogrammable and reconfigurable capabilities combined with relatively low non-recurring engineering costs (NRE) and short design cycle. Consequently, FPGAs are prevalent ICs in communication protocols and control signal commands. This presentation will demonstrate guidelines to estimate FPGA failure rates for ascent and in space operations. The guidelines will account for hardware, hardware description language, and radiation-induced failures. This presentation will also provide one example for applying the guidelines to estimate FPGA failure rate.
1	1330-1500	3	D3	SBIR Session	**Dawn Gratz & Jessica Glover**	**Small Business Innovation Research (SBIR)**	This session will provide an overview of the DoD Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program. The SBIR program is a highly competitive program that encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization. The STTR is another program that expands funding opportunities in the federal innovation research and development (R&D) arena. The unique feature of the STTR program is the requirement for the small business to formally collaborate with a research institution. The overview will address the process, schedule, and key features for writing a topic. Following the overview will be "hands on" guidance for writing a topic, so feel free to bring ideas.
2	0900-1030	9	A4	DAU Tutorial	**John Rice**	**Reliability & Additive Manufacturing**	Additive Manufacturing, to include 3D Printing, is revolutionizing the development of parts and assemblies in Government and industry. The ability to rapidly create prototypes, production items and spare parts is of interest to DoD in streamlining the acquisition of critical items. This rapid development presents both risks and opportunities relating to weapon system reliability. This presentation will address key reliability considerations from system concept through sustainment.

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2	0900-1030	11	B4	Tutorial	**Dr. Greg Harris**	**Model Based Enterprise**	Throughout modern history, since the Antebellum Era of manufacturing systems through Mass Production and into current day, most engineering and manufacturing activities relied on 2 Dimensional (2D) drawings in hardcopy or digital format to convey engineering data and to drive manufacturing processes. In more recent times new manufacturing data format standards and more capable engineering software, it is possible to perform engineering functions using data models. A Model-Based Enterprise (MBE) environment employs models rather than hardcopy documents as the authoritative source for all engineering activities throughout the product life cycle. In a MBE environment the model is used to drive all actions throughout the product lifecycle. With this approach data is created, consumed and added to by users throughout the lifecycle and supply chain without having to recreate the model or previously learned information.
2	0900-1030	5	C4	Tutorial	**Jason Martin** & **Dr. Farrington**	**What's the Point of Design of Experiments?**	This tutorial will provide an overview of Designof Experiments (DOE) techniques and approaches. It will discuss the value ofusing DOE in process improvement and system testing. The instructors willreview factorial experiments, fractional factorial experiments, computerdesigned experiments, and response surface designs. They will also reviewTaguchi's approach to DOE and the relationship to the traditional DOE approach.
2	0900-1030	3	D4a	Data Analytics	**Derek S. Fok**	**AH-64E System Level Embedded Diagnostics (SLED) Case Study**	The AH-64E includes a System-Level Embedded Diagnostics (SLED) capability. The system is hosted on the aircraft's mission computer and can uses parametric data and system state data to provide relevant and actionable maintenance information. It leverages all PBIT, CBIT, and IBIT fault reporting already performed on the system to create integrated health management results. SLED routes this information to a non-line of sight (NLOS) data network that empowers the aviation production control and maintenance organizations to react to aircraft issues (in terms of P4T2 – "Problem, People, Parts, Plan, Tools, and Time). The AH-64 environmental control systems (ECS) was recognized as having a high maintenance impact. This presentation reviews the design process and implementation of the AH-64E ECS updates and the SLED capability to continuously improve the information it provides.
2	0900-1030	3	D4b	Reliability	**David Sada**	**Modeling and Simulation**	This session will detail some of the RAM Engineering projects that have recently been conducted on various aircraft programs and maintenance facilities. The brief is intended to demonstrate how modeling and simulation tools are being used to solve practical, real-world problems being experienced throughout DoD entities. These typical Reliability Engineering processes and tools are being applied and utilized in the field today in order to provide tangible benefits to the warfighter. The benefits are realized in the form of better maintenance practices and scheduling, more accurate availability and readiness predictions in order to prepare for operations, and determination of root causes of deficiencies. While this brief focuses on DoD applications, the processes and tools used are applicable to other industries.
2	1100-1230	9	A5	Tutorial	**John Smith**	**Intro to Six Sigma**	The Lean Six Sigma methodology uses data and rigorous statistical analysis to identify defects in a process or product, reduce waste and variability, and achieve high quality well managed processes. Approaches to business performance improvement have evolved and grown since the early 1900s. Today process focused Lean Thinking and statistically driven Six Sigma methodology has been widely used by many organization to improve the business performance and optimizing the bottom-line benefits. This presentation reports an overview of the Lean Six Sigma methodology and the tools used to achieve high quality processes. Participants will gain knowledge on the Lean Six Sigma methodology and see how the tools can be used to improve quality, reduce cycle time and increase throughput within for-profit and not-for-profit business models.

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2	1100-1230	**11**	**B5**	Tutorial	**Dr. Dale Thomas**	**Model Based Systems Engineering**	This tutorial will provide an introduction to Model Based Systems Engineering (MBSE), including an overview of the Systems Modeling Language (SysML) and associate the MBSE concepts to traditional systems engineering artifacts and methods using real world examples.
2	1100-1230	**5**	**C5a**	Student Presenta-tions	**Javad Seif**	**Combined Maintenance Activities in Flow ShopSscheduling**	In practice, when two or more maintenance activities are scheduled consecutively (in a row) they are not performed separately. This is because they usually share certain tasks and resources. In this research we introduce the concept of combined maintenance activities in flow shop scheduling problems. The objective is to minimize the total costs of maintenance and lateness in completing the production jobs. A stochastic mixed-integer program is developed to mathematically and precisely models the problem. A simulation-optimization method is also presented for solving large-scale problems that cannot be solved efficiently with commercial solvers. We evaluate the performance of the solution method through computational experiment, and drive managerial implications for implementing this work. Finally, we show one of the applications of the presented work via a case study.
2	1100-1230	**5**	**C5b**	Student Presenta-tions	**Giulia Palma**	**NASA Habitat framework for an analysis of preference communication**	This abstract focuses on analyzing how NASA communicated its preferences to the NextSTEP-2 (Next Space Technologies for Exploration Partnerships) agencies. The tools used to analyze this research are value modelling and qualitative data analysis. NextSTEP-2, a solicitation put out by NASA in 2016 seeking industry proposals for concept studies on, among others, deep space habitation, fosters private-public partnerships between NASA and six commercial space companies. Appendix A of the Broad Agency Announcement-Habitat, and other Habitat related documents, have been collected and are being qualitatively coded to find patterns to reveal NASA's preferences. A code, here, is a summative word that is assigned to a paragraph, or sentence, of a document that is believed to best represent that document's portion. These codes are run through NVivo 11 (qualitative data analysis software) to study trend analysis and preferences. A value model, which is a mathematical representation of the stakeholder's preferences, will be created with the NVivo 11 findings. This research aims at understanding if and how NASA's preferences change over time. In the near future the way companies interpreted NASA's BAA and implemented what they thought were NASA's preferences will also be studied.
2	1100-1230	**5**	**C5c**	Student Presenta-tions	**Garima Bhatia**	**Evaluating benefits of SysML in creating value models using NASA's NEA Scout Project**	The use of model-based systems engineering (MBSE) has been growing to assist decision-makers in the design of complex systems. OMG's Systems Modeling Language (SysML) is a prime MBSE language used to model system hardware, software, and also the people and processes involved. SysML provides multiple system views, and the ability to represent systems so facilitates improved communication between designers and customers. Customers can understand the system better and assist designers in translating their requirements into design using SysML. Value-based design (VBD), another systems engineering approach, improves the design of systems by representing and communicating the true preferences of stakeholders. In VBD, the preferences of the stakeholders are represented by means of a mathematical function called value model. The value model is communicated throughout the organizational hierarchy to assist subsystem designers in their design, instead of requirements. This work explores the benefits of bringing together SysML and VBD in order to exploit the combined advantages, specifically in how value models can be created in SysML and if doing so can help enhancing their understanding. NASA's Near-Earth Asteroid (NEA) Scout project is used as an example in the work.

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2	1100-1230	5	D5	Tutorial	**Dr. Letha Etzkorn**	**Software Quality & Reliability**	Software reliability will be defined, and its relationship to dependability , fault avoidance, and fault tolerance will be discussed. The particular characteristics of software reliability relative to the software lifecycle will be examined. Reasons why software reliability has become more difficult over the years to achieve will be discussed. Failure behavior and metrics to describe failure behavior will be defined. Various methods to achieve software reliability will be presented. Various characteristics of software reliability models will be examined, including their limitations/failures and the advantages and disadvantages of predictive models vs. estimator models. The difficulties in combining different models in order to achieve a better overall reliability model will be discussed. The relationship between software metrics and software reliability will be examined, including limitations of software metrics overall and in respect to determining software reliability. The relationship between software reliability and code inspections will be discussed. Recent software reliability and software metrics research will be presented.
2	1330-1500	9	A6	Tutorial	**Dr. Sa'd Hamasha**	**Assessment of System Reliability**	The focus of this tutorial session is on the reliability assessment of components and systems. In analyzing a complex system, a particular failure law may not be applied to the entire system. The best approach is to determine an appropriate reliability or reliability model for each component of the system, and by applying the rules of probability according to the configuration of the components within the system, compute a system reliability. This tutorial session includes two main topics: 1. Statistics of Failure: It covers developing probabilistic reliability and failure rate functions, and developing reliability models based on the common statistical distributions such as Weibull distribution. Various summary measures of reliability, such as the mean time to failure will be described. 2. System Reliability: It covers computing system reliability using serial configuration, parallel configuration, and complex configuration (the more realistic!). Both system decomposition and system enumeration techniques will be discussed using practical examples.
2	1330-1500	11	B6	Tutorial	**Brandon Wall**	**MBSE Application(s)**	This tutorial will provide an introduction to the processes and techniques used to develop a system functional model using MBSE principles. Included will be discussion of the development of system use cases, Activity Diagrams and Sequence diagrams, including lessons learned across multiple Aviation and Missile programs
2	1330-1500	5	C6a	Student Presenta-tions	**Brett A. Shields**	**The Effects of Controls of Parameters on Properties of 3-D Printed Graphene-Polylactic Acid By Design of Experiments**	In this research the effects of control parameters on the mechanical properties of conductive polylactic acid produced by fused deposition modelling (FDM). This research determines the feasibility of controlling the responses with optimal printer settings, and gain insight on the effects the factors have on the quality of the end part. An experimental design (DOE) approach was taken to screen four factors for statistical significance on the responses. An orthogonal main effects plan is used to examine the significance of the printer settings on the resistivity, dimensional accuracy, and density of the material. The factors considered in the design are: layer thickness, print speed, build plate temperature, and extruder temperature, at two levels each. The results include bounds on the printed part's conductivity, y-direction inaccuracy domination of the total volume dimensional inaccuracy, and multiple statistically significant factors effect dimensional accuracy and density. The work also finds that the conductivity is not controllable with the printer settings. It is shown that depending on the desires of the manufacturer, the optimal printer settings may be in conflict with each other and a trade-off is necessary.

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2	1330-1500	**5**	**C6b**	Student Presenta-tions	**Joseph Clerkin**	**Value Modeling NASA Funding Allocations with a Congressional Stakeholder**	This research was done to better understand how NASA might improve budget spending to align more fully with Congressional preferences. This question arises from the lifecycle costs of large scale, complex engineered systems such as the Space Launch System (SLS). The question when framed in terms of the SLS is: Is it better for NASA to build an SLS or pay commercial launch organizations (e.g. SpaceX and Blue Origin) to provide heavy lift capabilities. This question can be answered by looking at the "value" provided by the missions that can be accomplished with heavy lift rockets. The previous research in this area mostly focused on attempting to create a purely macroeconomic model. The approach used in this research was to combine a macroeconomic function with microeconomic measures to allow for a value-based design approach to the problem; value-based design allows for optimization. This allowed for the development of a preliminary model; however, the real challenge for this research is in linking physics based models to the overall model and incorporating multiple technologies. To incorporate a fuller measure of NASA projects, the researchers are developing values for missions and determining how the technological projects fulfill those missions to develop technology values.
2	1330-1500	**3**	**D6**	Tutorial	**Dr. Harry Delugach**	**Python Programming**	Python is a programming language that is becoming widely popular due to its ease of use and its incorporation of object-oriented features. This tutorial will cover some of the history of the language's development, and give some examples of its powerful features. Some time will be spent discussing some object-oriented programming principles, why they are important, and how Python incorporates them. Attendees will leave the tutorial with a better understanding of both programming and object-oriented principles, as well as specific features of Python.