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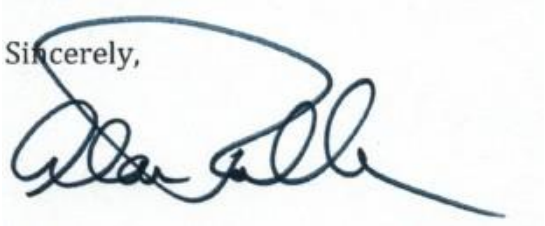
January 11, 2021

James D. Fielder, Jr., Ph.D.
Secretary of Higher Education
Maryland Higher Education Commission
Nancy S. Grasmick Building, 10th floor
6 North Liberty St.
Baltimore, MD 21201

Dear Dr. Fielder,

The SANS Technology Institute is pleased to submit the attached proposal to create a new Cloud Security post-baccalaureate certificate program. As the first program of its kind, in Maryland or anywhere, this post-baccalaureate certificate will provide information security practitioners with the education and skills needed to implement and maintain the security of enterprise networks which rely upon the cloud for key aspects of their operation.

I look forward to answering any questions you or your staff may have, or providing additional information as needed. I can be reached by cell phone at 301-520-2835.



Alan Paller
President
SANS Technology Institute

PROPOSAL FOR A POST-BACCALAUREATE CERTIFICATE IN CLOUD SECURITY

SANS Technology Institute

Office Use Only: PP#

Cover Sheet for In-State Institutions
New Program or Substantial Modification to Existing Program

Institution Submitting Proposal	SANS Technology Institute

Each action below requires a separate proposal and cover sheet.

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted:	Payment Type:	Payment Amount:	Date Submitted:
( ) Yes (●) No	( ) R*STARS (●) Check		

Department Proposing Program	N/A
Degree Level and Degree Type	Post-baccalaureate Certificate
Title of Proposed Program	Cloud Security
Total Number of Credits	12
Suggested Codes	HEGIS: 5199 CIP: 11.1003
Program Modality	EAH (●) On-campus EAH (●) Distance Education (*fully online*)
Program Resources	(●) Using Existing Resources ( ) Requiring New Resources
Projected Implementation Date	( ) Fall ( ) Spring (●) Summer Year: 2021
Provide Link to Most Recent Academic Catalog	URL: https://www.sans.edu/media/Graduate-Course-Catalog.pdf
Preferred Contact for this Proposal	Name: Eric Patterson Title: Executive Director Phone: (440) 321-3040 Email: epatterson@sans.edu
President/Chief Executive	Type Name: Alan Paller Signature: [signature] Date: 11 January 2021
	Date of Approval/Endorsement by Governing Board: 08 January 2021

Revised 4/2020

Table of Contents

A. Program Summary and Centrality to Institutional Mission Statement and Priorities

1. Program Description

The SANS Technology Institute (STI) proposes to launch a new program leading to a Post-Baccalaureate Certificate in Cloud Security. The proposed SANS Technology Institute post-baccalaureate certificate program is a 12-credit hour program with a cohesive set of learning outcomes focused on teaching cloud security applied concepts, skills, and technologies.

Cloud Security post-baccalaureate certificate students will complete two required core courses and two elective courses, earning four industry-recognized GIAC certifications.

A full course listing with course descriptions is provided in Section G.

The proposed program will be delivered using the same live classroom settings, online modalities, and student management systems that are currently employed in delivering STI's seven other post-baccalaureate certificate programs. Cloud Security post-baccalaureate certificate students will have, just as is true for all STI students, access to mentors and assistants online, will interact with each other online and at live events, and will take their exams required to complete the courses live at a proctored testing center or through remote proctoring sessions. For admission to the program, students must have completed a bachelor's degree at an accredited institution with a cumulative GPA of 2.8, and must have at least one year of experience in information technology or information security. Further details on the admission standards and process to STI post-baccalaureate certificate programs can be found online at https://www.sans.edu/admissions/certificates.

2. Relation to STI Mission and Strategic Goals

The proposed post-baccalaureate certificate program aligns well with STI's mission and vision.

Our mission calls for us to graduate "technically-skilled leaders to strengthen enterprise and global information security" who can, according to our vision, "design, champion, and manage the implementation and ongoing operation of state-of-the-art, enterprise-level cyber defenses" as they fulfill our institutional goal of "enabling private and public sector enterprises of the United States and its allies to preserve social order and to protect their economic rights and military capabilities in the face of cyber attacks."

B. Critical and Compelling Regional and Statewide Need as Identified in the State Plan

1. Critical Need for the Cloud Security Program

Increasingly, our society's data and applications are being hosted in the cloud; that is, large and critical segments of our world's enterprise networks are out-sourced to external platforms such as Amazon Web Services, Azure, Google Cloud, and other

cloud service providers (CSPs). This creates both incredible opportunities and new types of vulnerabilities. It also creates a new and developing reality whereby the maintenance and protection of cloud-based enterprise networks becomes an even more specialized endeavor within the already technically specialized field of cybersecurity. Like foreign languages, cloud environments impose their own novel terms, definitions, and operational syntax, and even experienced information security professionals will need to learn how to operate in an increasingly cloud-based environment. This ongoing trend will logically require security practitioners and leaders who are able to speak the language of cloud security, enabling them to securely integrate their on-premise network, endpoints, and operations with databases, applications, and system architecture which resides in the cloud.

The proposed Cloud Security post-baccalaureate certificate program aligns directly with Maryland Core Goal #6: Cybersecurity and Critical Infrastructure Protection.[1] This goal states that,

All critical government computer networks and systems should be protected from cyber attack. Critical private sector entities including utilities should be included in cyber security planning, training, and exercising. The State should be able to effectively respond to cyber incidents involving public and private networks that impact the well-being of Maryland residents, businesses, and the ability of the State to provide essential government services.

As one considers the critical information networks of the public and the private domains which enable and sustain the full range of societal activities within Maryland, educating current and future information security leaders on the concepts and techniques of cloud security is a necessary investment. Given Maryland's leading national role in the information security industry, it is only natural that the state should offer the first program of its kind which addresses this undeniable trend.

2. Alignment with the 2017–2021 Maryland State Plan for Postsecondary Education

Increase student success with less debt

This program will address the State Plan's goals to increase student success with less debt. Approximately 33% of our students fully fund their studies by way of employer tuition reimbursement, while another 43% utilize veteran education benefits. Currently, SANS Technology Institute does not participate in Title IV federal student loan programs and thus do not anticipate the creation of any student debt via this program. Similarly, our student retention and graduation rates for our post-baccalaureate certificate students remains consistently stable at greater than 85%.

Support for veterans

The Cloud Security program also targets elements of other Strategies in the Maryland State Plan. Strategy 7 calls for special efforts to support veterans. Approximately 43%

[1] http://gohs.maryland.gov/va/ and http://www.mcac.maryland.gov/how_to_help/H2H_CIP/index.html

of our current study body is comprised of veterans, with nearly all of them using some combination of GI Bill benefits and employer tuition reimbursement to increase their knowledge and skills as they enter or further establish themselves in the civilian workforce. Given their inherent familiarity with joint operations and the integration of offensive and defensive activities, this program will draw upon the ingrained perspective of military veterans who are seeking to advance their information security careers.

C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State

1. Market Demand

The National Institute of Standards and Technology (NIST) supports a website called CyberSeek that contains data on cybersecurity jobs and lists the number of current job openings by state and metropolitan area. In this section we combine the CyberSeek data with employment projections from the Maryland Department of Labor Licensing and Regulation (DLLR) to estimate the demand for the BACS program in Maryland and in the region.

CyberSeek states that the supply of cybersecurity workers nationally is "very low," with 285,681 job openings relative to a total employed workforce of 746,858 (a ratio of 0.38, or, "for every 100 employed workers, the market seeks another 38 people"). The ratio of "openings requesting a GIAC certification" to "holders of GIAC certifications" is nearly twice as high at 0.64 (or, "for every 100 current GIAC certification holders, the market seeks another 64"). In Maryland alone, CyberSeek shows that there are 1,769 current job openings that specifically request GIAC certification holders. These data indicate a high demand not just for cybersecurity workers, but especially for those who have proven, by holding GIAC certifications, that they have the skills to do the job.

Table 1. Current Positions and Projected Growth to 2024 in CyberSeek's "Top Cybersecurity Job Titles"

Job Title	Maryland Positions in 2014	Growth to 2024	Growth in Percent
Cyber Security Engineer			
Cyber Security Analyst	3,514	1,829	52%
Network Engineer/Architect	5,678	1,534	27%
Cyber Security Manager/Administrator	9,780	2,494	25%
Software Developer/Engineer	29,677	10,423	35%
Systems Engineer			
Systems Administrator	14,206	3,606	25%
Vulnerability Analyst/Penetration Tester			
IT Auditor	28,974	6,282	22%
Total	**91,829**	**26,168**	**28%**

Source: http://www.dllr.state.md.us/lmi/iandoproj/maryland.shtml (accessed April 2, 2020).

CyberSeek estimates the number of current cybersecurity job openings in Maryland at 14,535, which is not inconsistent with the DLLR numbers.

As alluded to already above in B.1., "Critical Need for the Cloud Security Program," any and all of these current or future information security professionals in Maryland will eventually require an increasing degree of familiarity with the unique environment of the cloud.

2. Current and Projected Supply of Prospective Graduates

Cybersecurity jobs are already an important part of Maryland's economy, comprising the second highest concentration of professional and technical workers among all fifty states. With the increasing recognition of the vulnerability of critical public and private networks and the need to better protect those networks against constantly evolving threats, it is reasonable to expect that, in conjunction with the State Plan, Maryland will continue to attract additional information security workers and separating military veterans who wish to enter into this challenging field. This growth will call for educated technical leaders with diverse skillsets and the ability to implement, develop, integrate, orchestrate, and lead cloud security operations.

D. Reasonableness of Program Duplication

1. Similarities and Differences between the Cloud Security Program and Other Programs Awarding the Same Degree

In determining whether a program is unreasonably duplicative, according to the Maryland Code of Regulations (COMAR 13B.02.03.09(C), the Secretary shall consider (a) the degree to be awarded; (b) the area of specialization; (c) the purpose or objectives of the program to be offered; (d) the specific academic content of the program; (e) evidence of equivalent competencies of the proposed program in comparison to existing programs; and (f) an analysis of the market demand for the program. The analysis on unreasonable duplication shall include an examination of factors including (a) the role and mission; (b) accessibility; (c) alternative means of educational delivery, including distance education; (d) analysis of enrollment characteristics; (e) residency requirements; (f) admissions requirements; and (g) educational justification for the dual operation of programs broadly similar to unique or high-demand programs at historically black institutions.

Currently, we are unaware of any educational program which is specifically seeking to produce practitioners who are specifically prepared to operate in a cloud environment. The STI Cloud Security post-baccalaureate certificate program is intended to provide that opportunity, especially for those already employed in the field who require focused and specialized training in this area to build upon and supplement their general cybersecurity education and experience.

Our analysis of these factors clearly demonstrates that the STI Cloud Security program is not duplicative in any way, and that it is an important addition to the educational offering in Maryland. A scan was conducted of the MHEC "Classification of Instructional Programs" (CIP) database to check for similar existing programs at any

MHEC authorized institution of higher education. Specifically, we looked at the following CIPs:

COMPUTER AND INFORMATION SCIENCES, GENERAL- 110101
INFORMATION TECHNOLOGY- 110103
INFORMATION SCIENCE/STUDIES- 110401
COMPUTER SYSTEMS NETWORKING AND TELECOMMUNICATIONS- 110901
COMPUTER AND INFORMATION SYSTEMS SECURITY- 111003

We detected no similar programs with this specific focus at any degree level. Morgan State University and University of Maryland University College offers various programs in cloud computing, and Capitol Technology University offers a program in secure cloud computing, however none of these are specifically focused upon designing, implementing, and maintaining the security of cloud-based networks.

Degree to Be Awarded

Post-baccalaureate certificate.

Specific Academic Content of the Program; Evidence of Equivalent Competencies

No other institution currently enables students and graduates to earn industry-recognized certification exams as a core element of their program. Graduates of STI's Cloud Security program will hold four industry-recognized GIAC certifications in addition to their post-baccalaureate certificate, each of which is generally recognized by employers as a reliable indicator of professional skill.

Alternative Means of Educational Delivery, including Distance Education

STI's Cloud Security program has the unique ability to offer students the flexibility to take their courses either through live in-classroom instruction or via our award-winning OnDemand distance-learning system. The program also enables students to enroll with an individualized, flexible academic plan that allows each of them to continue to work a full-time job while they complete the program.

3. Role and Mission

- Cybersecurity education is the sole focus of STI's mission**.** As discussed in section A.2., Relation to STI Mission and Strategic Goals, above, the alignment between our mission, vision, and goals and the specific purpose of this proposed post-baccalaureate certificate program intersects exactly with Maryland Core Goal #6 by creating future leaders and expert practitioners in both the public and private sectors who will work together to protect Maryland's critical enterprise networks.

Admissions Requirements

STI's admission requirements for Cloud Security program will be as already established for our existing post-baccalaureate certificate programs:

- Have at least 12 months of professional work experience in information technology or information security.
- Be employed or have current access to an organizational environment that allows you to apply the concepts and hands-on technical skills learned in the program. This requirement may be waived under certain circumstances given the current situation and uncertainty about unemployment rates at specific times.
- Have earned a baccalaureate degree from a recognized college or university, or equivalent international education, with a minimum cumulative grade point average of 2.80

E. Relevance to High-Demand Programs at Historically Black Institutions (HBIs)

1. Discuss the Program's Potential Impact On High-Demand Programs at HBIs

No HBI offers a comparable credential.

F. Relevance to the Identity of Historically Black Institutions (HBIs)

1. Discuss the Program's Potential Impact on the Uniqueness, Identities of HBIs

Generally, the Cloud Security program has no impact on the uniqueness or identity of any of the HBIs.

G. Adequacy of Curriculum Design and Delivery to Related Learning Outcomes

1. Program Outline and Requirements

Required Courses

Required core courses (6 credit hours):

Students will take these two core courses:
ISE 6610 (SANS Course SEC 488): Cloud Security Essentials | GCLD: GIAC Cloud Security Essentials (3 credits)
ISE 6612 (SANS Course SEC 510): Public Cloud Security: AWS, Azure, and GCP | GIAC certification under development (3 credits)

ISE 6610 Cloud Security Essentials (3 credits)

SANS class: SEC 488, Cloud Security Essentials
Assessment: GIAC GCLD
3 Credit Hours

ISE 6610, Cloud Security Essentials. New technologies introduce new risks. This course will equip students to implement appropriate security controls in the cloud, often using automation to "inspect what you expect." Mature CSPs have created a variety of security services that can help customers use their products in a more secure manner, but much about cloud security still resides with the customer organization. This course covers real-

world lessons using security services created by the CSPs as well as open-source tools. Each lesson features hands-on lab exercises to help students practice the lessons learned. Students will progressively layer multiple security controls in order to end the course with a functional security architecture implemented in the cloud.

The course begins by addressing one of the most crucial aspects of the cloud - Identity and Access Management (IAM). From there, students will learn to secure the cloud through discussion and practical, hands-on exercises related to several key topics to defend various cloud workloads operating in the different CSP models of: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

Students Will Be Able To:

- Identify the risks and risk control ownership based on the deployment models and service delivery models of the various products offered by cloud service providers (CSPs).
- Evaluate the trustworthiness of CSPs based on their security documentation, service features, third-party attestations, and position in the global cloud ecosystem.
- Create accounts and use the services of any one the leading CSPs and be comfortable with the self-service nature of the public cloud, including finding documentation, tutorials, pricing, and security features.
- Articulate the business and security implications of a multi-cloud strategy.
- Secure access to the consoles used to access the CSP environments.
- Use command line interfaces to query assets and identities in the cloud environment.
- Use hardening benchmarks, patching, and configuration management to achieve and maintain an engineered state of security for the cloud environment.
- Evaluate the logging services of various CSPs and use those logs to provide the necessary accountability for events that occur in the cloud environment.
- Configure the command line interface (CLI) and properly protect the access keys to minimize the risk of compromised credentials.
- Use basic Bash and Python scripts to automate tasks in the cloud.
- Implement network security controls that are native to both AWS and Azure.
- Employ an architectural pattern to automatically create and provision patched and hardened virtual machine images to multiple AWS accounts.
- Use Azure Security Center to audit the configuration in an Azure deployment and identify security issues.
- Use Terraform to deploy a complete "infrastructure as code" environment to multiple cloud providers.
- Leverage the Cloud Security Alliance Cloud Controls Matrix to select the appropriate security controls for a given cloud network security architecture and assess a CSP's implementation of those controls using audit reports and the CSP's shared responsibility model.

- Follow the penetration testing guidelines put forth by AWS and Azure to invoke your "inner red teamer" to compromise a full stack cloud application
- Use logs from cloud services and virtual machines hosted in the cloud to detect a security incident and take appropriate steps as a first responder according to a recommended incident response methodology.
- Perform a preliminary forensic file system analysis of a compromised virtual machine to identify indicators of compromise and create a file system timeline.

ISE 6612 Public Cloud Security: AWS, Azure, and GCP (3 credits)

SANS class: SEC510: Public Cloud Security: AWS, Azure, and GCP
Assessment: GIAC certification under development
3 Credit Hours

ISE 6620, Public Cloud Security: Amazon Web Services (AWS), Azure, and Google Cloud Platform (GCP) teaches students how the major cloud providers work and how to securely configure and use their services and Platform as a Service (PaaS) offerings.

Organizations in every sector are increasingly adopting cloud offerings to build their online presence. However, although cloud providers are responsible for the security of the cloud, their customers are responsible for what they do in the cloud. Unfortunately, the providers have made the customer's job difficult by offering many services that are insecure by default. Worse yet, with each provider offering hundreds of different services and with many organizations opting to use multiple providers, security teams need a deep understanding of the underlying details of the different services in order to lock them down. As the landscape rapidly evolves and development teams eagerly adopt the next big thing, security is constantly playing catch-up in order to avert disaster.

This course provides cloud security practitioners, analysts, and researchers with an in-depth understanding of the inner workings of the most popular public cloud providers: AWS, Microsoft Azure, and GCP. Students will learn industry-renowned standards and methodologies, such as the MITRE ATT&CK Cloud Matrix and CIS Cloud Benchmarks, then apply that knowledge in hands-on exercises to assess a modern web application that leverages the cloud native offerings of each provider. Through this process students will learn the philosophies that undergird each provider and how these have influenced their services.

The Big 3 cloud providers alone provide more services than any one company can consume. As security professionals, it can be tempting to limit what the developers use to the tried-and-true solutions of yesteryear. Unfortunately, this approach will inevitably fail as the product development organization sidelines a security entity that is unwilling to change. Functionality drives adoption, not security, and if a team discovers a service offering that can help get its product to market quicker than the competition, it can and should use it. This course gives students the ability to provide relevant and modern guidance and guardrails to these teams to enable them to move both quickly and safely.

THIS COURSE WILL PREPARE STUDENTS TO:

- Understand the inner workings of cloud services and Platform as a Service (PaaS) offerings in order to make more informed decisions in the cloud
- Understand the design philosophies that undergird each provider and how these have influenced their services in order to properly prescribe security solutions for them
- Discover the unfortunate truth that many cloud services are adopted before their security controls are fully fleshed out
- Understand Amazon Web Services (AWS), Azure, and Google Cloud Platform (GCP) in depth.
- Understand the intricacies of Identity and Access Management, one of the most fundamental concepts in the cloud and yet one of the last understood
- Understand cloud networking and how locking it down is a critical aspect of defense-in-depth in the cloud
- Analyze how each provider handles encryption at rest and in transit in order to prevent sensitive data loss
- Explore the service offering landscape to discover what is driving the adoption of multiple cloud platforms and to assess the security of services at the bleeding edge
- Understand the complex connections between cloud accounts, providers, and on-premise systems and the cloud
- Perform secure data migration to and from the cloud

Understand Terraform Infrastructure-as-Code well enough to share it with your engineering team as a starting point for implementing the controls discussed in the course

Students Will Learn:

- How to comprehensively remediate common web application vulnerabilities.
- How to apply defensive application design and coding practices to avoid security vulnerabilities.
- The HTTP protocol and new technologies such as HTTP/2, QUIC (HTTP/3), and Websockets that affect the protocol stack.
- How to move away from basic web application security principles of "validating more" and implement effective security controls against vulnerabilities that input validation simply does not fix.
- How to customize, implement, and maintain a baseline security standard for the web applications development lifecycle (SANS SWAT checklist), improving security and reducing exposure to common vulnerabilities such as the OWASP Top 10 Risks.
- How to leverage HTTP header-level protection to apply strong defense systems on the client side by building another layer of defense on top of secure coding on the server side.
- How to design better and stronger security architecture that includes infrastructure aspects in the design process.
- How to leverage and uplift the modern security features in the web browser to further enhance the overall security of the application.

Students Will Be Able To:

- Understand the major risks and common vulnerabilities related to web applications through real-world examples.

- Mitigate common security vulnerabilities in web applications using proper coding techniques, software components, configurations, and defensive architecture.
- Understand the best practices in various domains of web application security such as authentication, access control, and input validation.
- Fulfill the training requirement as stated in PCI DSS 6.5.
- Deploy and consume web services (SOAP and REST) in a more secure fashion.
- Proactively deploy cutting-edge defensive mechanisms such as defensive HTTP response headers and Content Security Policy to improve the security of web applications.
- Strategically roll out a web application security program in a large environment.
- Incorporate advanced web technologies such as HTML5 and AJAX cross-domain requests into applications in a safe and secure manner.
- Develop strategies to assess the security posture of multiple web applications.

Electives Courses: (6 credit hours)

Students will select two of the following elective course options:

ISE 6615 (SANS Course SEC 522): Defending Web Applications Security Essentials | GWEB: GIAC Web Application Defender (3 credits)
ISE 6630 (SANS Course SEC 588): Cloud Penetration Testing | GCPN: GIAC Cloud Penetration Tester (3 credits)
ISE 6650 (SANS Course SEC 540): Cloud Security and DevOps Automation | GCSA: GIAC Cloud Security Automation (3 credits)
ISE 6620 (SANS Course SEC 541): Cloud Security Monitoring and Threat Detection | GIAC certification under development (3 credits)
ISE 6640 (SANS Course SEC 584): Cloud Native Security: Defending Containers & Kubernetes | GIAC certification under development (3 credits)

ISE 6615 Defending Web Applications Security Essentials (3 credits)

SANS class: SEC 522, Defending Web Applications Security Essentials
Assessment: GIAC GWEB
3 Credit Hours

ISE 6615 will present mitigation strategies from an infrastructure, architecture, and coding perspective alongside real-world techniques that have been proven to work. The course introduces the nature of each vulnerability to help you understand why it happens, then shows students how to identify the vulnerability and provide options to mitigate it.

To maximize the benefit for a wider range of audiences, the discussions in this course will be programming language agnostic. The focus will be maintained on security strategies rather than coding-level implementation.

Students will find the course useful when they are supporting or creating either traditional web applications or more modern web services for a wide range of front ends like mobile applications. The course is particularly well suited to application security analysts, developers, application architects, pen testers, auditors who are interested in recommending proper

mitigations for web security issues, and infrastructure security professionals who have an interest in enhancing the defense of web applications.

The course will also cover additional issues the authors have found to be important in their day-to-day web application development practices. The topics that will be covered include:

- The OWASP Top 10
- Selected specific web application issues from the Common Weakness Enumeration (CWE) Top 25 Most Dangerous Software Errors
- Infrastructure security and configuration management
- Securely integrating cloud components into a web application
- Authentication and authorization mechanisms, including single sign-on patterns
- Application language configuration
- Application coding errors like SQL injection, cross-site request forgery, and cross-site scripting
- Web 2.0 and its use of web services (REST/SOAP)
- Cross-domain web request security
- Business logic flaws
- Protective HTTP headers

- ISE 6615 features full-day lab with hands-on exercises on how to secure a web application, starting with securing the operating system and web server, finding configuration problems in the application language setup, and finding and fixing coding problems in the site. The course makes heavy use of hands-on exercises and will conclude with a large defensive exercise that reinforces the lessons learned throughout the course.

ISE 6630 Cloud Penetration Testing (3 credits)

SANS class: SEC 588 Cloud Penetration Testing
Assessment: GIAC GCPN
3 Credit Hours

Computing workloads have been moving to the cloud for years. Analysts predict that most, if not all, companies will have workloads in public and other cloud environments in the very near future. While organizations that start in a cloud-first environment may eventually move to a hybrid cloud and local data center solution, cloud usage will not decrease significantly. So when it comes to assessing risk to organizations, we need to be prepared to assess the security of cloud-delivered services. In this course you will learn the latest in penetration testing techniques focused on the cloud and how to assess cloud environments.

The most commonly asked questions regarding cloud security are "Do I need training for cloud-specific penetration testing" and "Can I accomplish my objectives with other pen test training and apply it to the cloud?" The answer to both questions is yes, but to understand why, we need to address the explicit importance of having cloud-focused penetration testing. In cloud-service-provider environments, penetration testers will not encounter a traditional data center design. Specifically, what we rely on to be true in a traditional setting - such as who owns the Operating System, who owns the infrastructure, and how the applications are running

- will likely be very different. Applications, services, and data will be hosted on a shared hosting environment that is potentially unique to each cloud provider.

What makes cloud native different? The Cloud Native Computing Foundation, which was chartered to provide guidance on what is a cloud-first and cloud-native application, states that the application and environment will be composed of containers, service meshes, microservices, immutable infrastructure, and declarative APIs.

While some of these items are available in a non-cloud environment, in the cloud these features are further decomposed into services that are made available by cloud providers. In this environment, an example of complexity is a microservices architecture in which there may be a virtual machine, a container, or even what is considered a "serverless" hosting area. We must therefore deal with additional complexity in order to appropriately assess this environment, stay within the legal bounds, and learn new and different ways to perform what we would consider legacy attacks.

ISE 6630 dives into these topics as well as other new topics that appear in the cloud like microservices, in-memory data stores, files in the cloud, serverless functions, Kubernetes meshes, and containers. The course also specifically covers Azure and AWS penetration testing, which is particularly important given that Amazon Web Services and Microsoft account for more than half of the market. The goal is not to demonstrate these technologies, but rather to teach students how to assess and report on the true risk that the organization could face if these services are left insecure.

ISE 6650 Cloud Security and DevOps Automation (3 credits)

SANS class: SEC 540 Cloud Security and DevOps Automation
Assessment: GIAC GCSA
3 Credit Hours

ISE 6650 provides development, operations, and security professionals with a methodology to build and deliver secure infrastructure and software using DevOps and cloud services. Students will explore how the principles, practices, and tools of DevOps can improve the reliability, integrity, and security of on-premise and cloud-hosted applications. Starting with on-premise deployments, the course begins with an examination of the Secure DevOps methodology and its implementation using lessons from successful DevOps security programs. Students will gain hands-on experience using popular open-source tools to automate Configuration Management ("infrastructure as Code"), Continuous Integration (CI), Continuous Delivery (CD), containerization, micro-segmentation, automated compliance ("Compliance as Code"), and Continuous Monitoring. After laying the DevSecOps foundation, the course continues with an exploration of DevOps workloads to the cloud, build secure cloud infrastructure, and deliver secure software.

ISE 6620 Cloud Security Monitoring and Threat Detection (3 credits)

SANS class: SEC 541, Cloud Security Monitoring and Threat Detection
Assessment: GIAC certification under development
3 Credit Hours

Cloud infrastructure provides organizations with new and exciting services to better meet the demands of their customers. However, these services bring with them new challenges, particularly the need to effectively hunt down and identify threats attacking an organization's infrastructure. Securely operating cloud infrastructure requires new tools and approaches.

This course is an introduction to the native services available within Amazon Web Services (AWS) to gather, analyze, and detect threats. Students will learn about common attack techniques used against cloud infrastructure, and then investigate how to detect those threats in AWS. SEC541 is all about gaining the hands-on experience that gives students the skills and confidence to seek out threats in your own environment. We'll also discuss architectural design patterns that can make detection easier and attacks harder, as well as ways to automate tasks wherever possible.

This course will prepare students to:

- Understand the threats against AWS cloud infrastructure
- Utilize AWS core logging services.
- Research, detect, and investigate threats
- Incorporate scripting and automation to make threat hunters more efficient
- Understand how good architecture improves threat detection

ISE 6640 Cloud Native Security: Defending Containers & Kubernetes (3 credits)

SANS class: SEC 584, Cloud Native Security: Defending Containers & Kubernetes
Assessment: GIAC certification under development
3 Credit Hours

Cloud native infrastructure and service providers are enabling organizations to build and deliver modern systems faster than ever. The end-to-end toolchain supporting the systems includes managed services to create cloud infrastructure, store source code, build containers, and manage clusters. For information security professionals, the attack surface created by these modern systems can be difficult to defend and monitor. This course explores Docker and Kubernetes, key components of the cloud native infrastructure stack, providing in-depth analysis of the attack surface, misconfigurations, attack patterns, and hardening steps. Students will gain hands-on experience building, exploring, and securing real-world modern systems.

This course starts by painting a portrait of the modern cloud-native infrastructure hosted in Google Cloud. After deploying cloud resources, students examine methods of compromise, walk through attack scenarios, and then shift their focus to defending and remediating infrastructure services. This includes hardening the Kubernetes orchestrator and workload configuration, deploying security testing and monitoring software in

pipelines and clusters, cryptographically signing images and build pipelines, and applying AppArmor and Seccomp profiles to containerized workloads.

The course then shifts its focus to defending a live Kubernetes deployment. After students identify several Kubernetes weaknesses, hands-on exercises attacking and remediating security and network policies and admission controllers will help them lock down the lab environment. Attacks and controls are threat-modeled to ensure they are applied correctly, tested out-of-band to ensure their efficacy, and applied at multiple stages throughout the pipeline to enhance engineers' productivity and feedback loops.

THIS COURSE WILL PREPARE STUDENTS TO:

- Understand why many cloud native services have evolved quickly and without security as a top consideration
- Secure containerized applications and defend orchestration workloads
- Leverage automated testing tools to perform security testing and harden your deployments

STUDENTS WILL BE ABLE TO:

- Use real-world exploits to target key application deployment components
- Understand the risks involved in running cloud native infrastructure
- Explore vulnerabilities to cloud native deployments through authentication, pipeline, and supply chain exploits
- Exploit and then secure application deployments via Docker and Kubernetes
- Determine how vulnerabilities are exploited and how defenses are designed

2. Educational Objectives and Intended Student Learning Outcomes

The three primary educational objectives of the program are to:

a) PLO1: Practice and demonstrate mastery of fundamental cloud security knowledge and skills.
b) PLO2: Understand, practice, and demonstrate mastery of important defensive techniques and identify indications of an attack in order to detect / respond to / mitigate incidents on cloud-based networks and applications.
c) PLO3: Understand, practice, and demonstrate mastery of cloud-based applications and be able to securely implement, integrate, and maintain those applications.

The intended student learning outcomes are directly supported by the fulfillment of these core course learning objectives:

PLO 1: ISE 6610 Cloud Security Essentials

- This core course enables students to identify the risks and risk control ownership based on the deployment models and service delivery models of the various products offered by cloud service providers (CSPs).

PLO 2: ISE 6610 Cloud Security Essentials & ISE 6615 Defending Web Applications Security Essentials

- ISE 6610 enables students to evaluate the trustworthiness of CSPs based on their security documentation, service features, third-party attestations, and position in the global cloud ecosystem.
- ISE 6615 prepares students to comprehensively remediate common web application vulnerabilities and to apply defensive application design and coding practices to avoid security vulnerabilities.

PLO 3: ISE 6615 Defending Web Applications Security Essentials

- This course enables students to design better and stronger security architecture that includes infrastructure aspects in the design process, and prepares them to leverage and uplift the modern security features in the web browser to further enhance the overall security of the application.

Each program learning outcome and course objective listed above is measured by the respective GIAC certification examination associated with each of the two core courses that the student completes from those listed in Section G1.

Learning objectives are updated at least every four years after the assessment of rigorous, detailed, and updated job task analyses that have made the passing of these exams globally recognized as being indicative of having mastered the knowledge taught in our technical courses and the capabilities required to engage in real-world cybersecurity activities.

3. How General Education Requirements Will Be Met

As an post-baccalaureate certificate program, the Cloud Security program does not include general education requirements.

4. Specialized Accreditation/Certification Requirements

Each student who earns a Cloud Security post-baccalaureate certificate will have achieved certification in four areas of cybersecurity using Global Information Assurance Certifications (GIAC).

H. Articulation

As a technically focused post-baccalaureate certificate program and the first of its type, no articulation agreements are anticipated.

I. Adequacy of Faculty Resources (outlined in COMAR 13B.02.03.11).

The faculty serving the students of the proposed Cloud Security program is comprised of the very same instructors who currently teach the 1000+ enrolled graduate and undergraduate students at the SANS Technology Institute as well as the more than 30,000 professionals across the globe each year enrolled at SANS via live and online

courses. Their qualifications to fulfill our mission were recently reviewed and confirmed by the Visiting Team of the Middle States Commission on Higher Education as part of STI's re-accreditation review in 2018.

Adding 25 to 50 students (see Section L, Financial Resources) to the instructors' teaching load is the equivalent of far less than 1% increase in enrollment per class. Therefore, we conclude that our faculty is more than adequate in both capability and number to serve this new program.

Meeting STI's mission requires that STI faculty and graduates are "scholar-practitioners." STI uses the term "scholar-practitioner" to designate people who are both (1) highly trained professional practitioners focused on information security, and (2) scholars in the sense that they both contribute to and consume the research required to advance that professional practice. The combination enables them to incorporate new research into their work and create the new knowledge and solutions that others seek to use. Our faculty are not solely scholars, they must also be advanced practitioners of the subjects they teach so that they can show STI students how to practice security effectively. This gives STI students an advantage relative to graduates of other programs in which students learn theory, but not up-to-date practice. Finally, our faculty must be talented teachers, able to communicate often-difficult technical information in a clear and compelling manner.

Among STI's faculty are people who are called upon to investigate attacks on the U.S. government and our largest commercial enterprises, who are entrusted to teach practitioners of cybersecurity at the highest and most sensitive (classified) levels, and who, through their professional practice and research, advance our understanding of cyber threats and potential remediation and then transmit that knowledge forward to our students and the larger community. Even beyond their superlative technical abilities, our faculty have skills as teachers that truly set them apart and allow them to impart sometimes dense technical lessons with enthusiasm, applicable real-world examples, and charismatic engagement.

STI's faculty and leadership have earned significant general and industry recognition for their roles and expertise. To list just a few:

- President Alan Paller was the Co-chair of the Department of Homeland Security's Task Force on CyberSkills, and had been a Charter Member of President Clinton's National Information Assurance Council.
- President Paller and James Lyne are two of fewer than 30 people currently listed on the Infosecurity Europe Hall of Fame.
- Dr. Johannes Ullrich was recognized as one of the 50 most powerful people in networking by NetworkWorld. Social media is replete with examples of references to SANS Instructors, including items like Security Leaders to Follow on Social Media.
- STI faculty are repeatedly invited to keynote presence at RSA, the industry's largest convocation for information security research and practice. For each of the last seven years, members of STI's faculty, led by President Alan Paller, have hosted one of the main keynotes at "RSA," focusing their presentation on their expectations for the seven most dangerous new attack techniques they expect to impact the industry in the subsequent year. The press release regarding the entire event issued by RSA is indicative

of our faculty's prominence in the industry: not only are they one of the three keynotes highlighted (together with a Cryptographer's panel, which is the core activity of RSA), but they are presented prior to and in advance of the CEOs, Presidents, and leading executives from companies such as Microsoft, Hewlett Packard Enterprise, Symantec, Intel Security, and Cisco Security.

• STI faculty are sought after by the news media for their commentary on cybersecurity topics – STI faculty are frequently sought-after as commentators for breaking news articles on adverse cyber events. Their commentary appears in general news publications such as the New York Times and Wall Street Journal, in general magazines such as Forbes and Fortune, and their work is highlighted on various TV news programs. They are sought-after speakers even for general industry events, such as TED (James Lyne's February, 2013 TED talk on 'everyday cybercrime' has been viewed nearly 1.7 million times).

As shown in Figure 1 (below), the SANS instructor development and assessment process requires a prospective STI faculty member to successfully complete four increasingly competitive steps (listed here and described in greater detail below):

(1) Earn scores on a Global Information Assurance Certification (GIAC) examination above 85.

(2) Earn high marks in mentoring (lab/teaching assistant) two groups of students.

(3) Earn high marks as "community instructors" in teaching two classes held at small Residential Institutes.

(4) Earn high marks as a supervised instructor at a large Residential Institute.

Only after completing these four steps would an individual would be eligible to be a SANS Certified Instructor and potentially be appointed to the STI faculty.

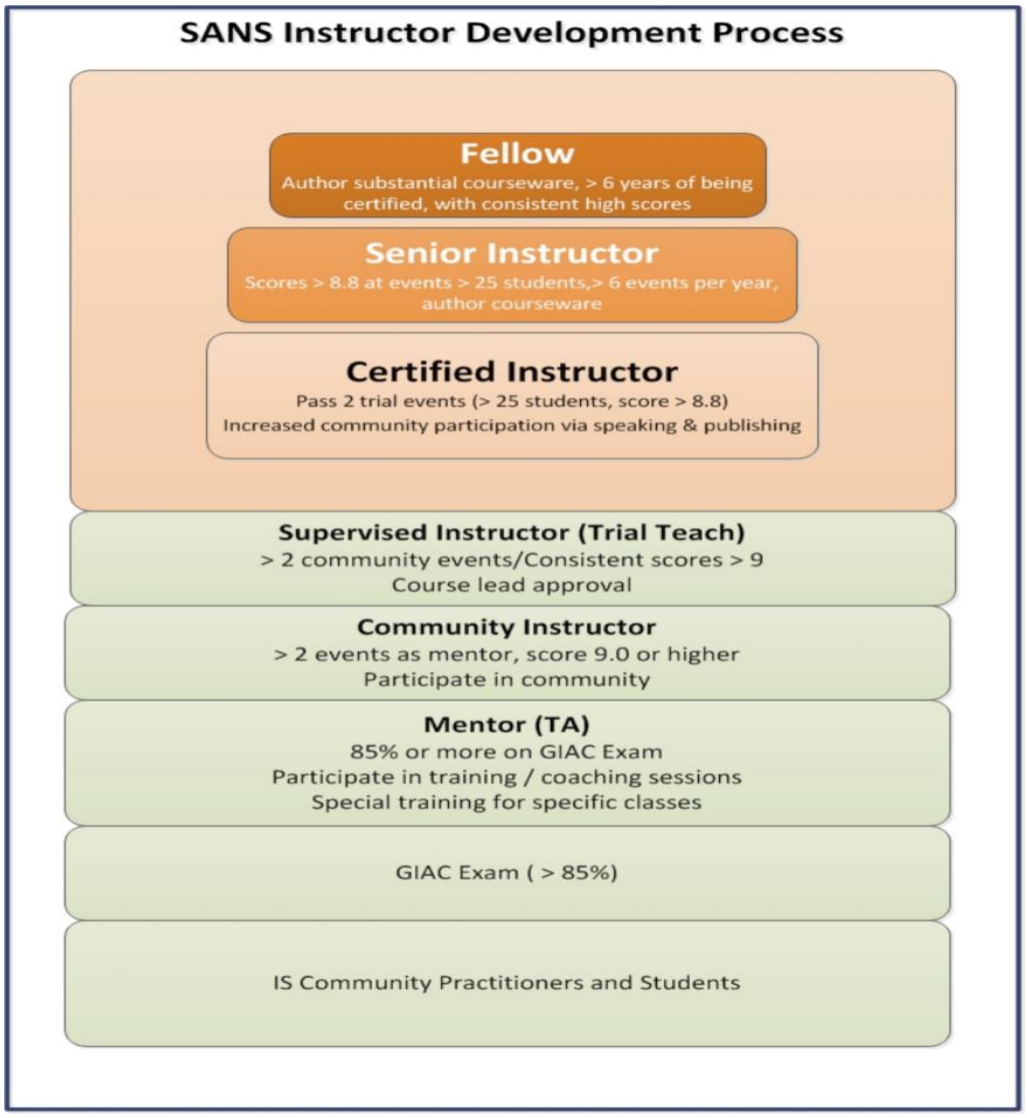
In the first step, teaching candidates are recruited from practitioners who score 85 or higher on the GIAC exam(s) relevant to the course(s) they will train to instruct. If selected, teaching candidates begin as designated SANS mentors and are then monitored and coached as they begin helping students who use online resources for instruction but look to SANS mentors for help with the lab exercises. The mentor stage in the SANS instructor development pipeline parallels the role of lab/teaching assistant in many college settings. Mentoring allows teaching candidates to develop and demonstrate their ability to coach students, demonstrate solutions to many hands-on exercises, and clarify the more challenging concepts being discussed in the courses. Students rank mentors on teaching skill and overall effectiveness, which allows SANS to determine whether the mentor is sufficiently talented to move on to the next step.

Mentors who earn outstanding scores in two separate 12-week mentoring assignments may then advance to the second step: closely monitored teaching engagements at small, community-based learning events (10-25 students), where they are designated as "community instructors."

Instructional effectiveness scores, part of the course evaluation process used for every teaching session delivered by SANS, are used to evaluate each instructor's ability to teach, as well as to measure the teacher's continued mastery of the material. Candidates who earn outstanding scores in effectiveness and satisfaction in two separate six-day community-teaching opportunities are invited to be guest instructors at a larger learning

event. Those who earn outstanding scores at the larger event are designated as Certified Instructors.

Figure 1 SANS Instructor Development and Assessment Process



Fewer than half of more than 12,000 persons who take and pass GIAC information security certification exams each year are even eligible to become SANS mentors. Because of increasingly stringent class size and ratings requirements, the number of people who are promoted to each higher rank of teaching decreases as you go up the ladder. Thus, certified SANS instructors represent approximately 1 in 800 (15 selected out of 12,000) of the practitioners talented enough to pass GIAC exams. As importantly, SANS instructors retain their positions only if their ratings on course value (reflecting in part the currency and applicability of the examples used) and teaching effectiveness, which are recorded for every teaching engagement, remain above a high cutoff point (4.1 on a scale of 5). They must also remain ahead of other candidates coming up through the instructor development pipeline.

Once appointed, qualified individuals serve in dual roles as SANS Instructors and STI faculty members. Each appointed instructor is a proven, real-world practitioner whose

experiences are especially relevant to the school, enabling them to author courses of value, relevancy, and currency, as well as to deliver these courses to students in an effective, highly engaging manner that includes supplying ever-renewed examples from their work practice. These industry-recognized demarcations indicate technical achievement in the field, superior teaching effectiveness and student engagement as exemplified in the classroom and online, and successful completion of a competitive development process that employs both student and peer-faculty feedback to prove that the instructors possess these qualities.

While a handful of faculty members serve in full-time teaching and research roles, most are adjunct, scholar-practitioners who teach less than full-time for the school or our parent, SANS, so that they can engage in the practice of cybersecurity, keep their skills advanced and current, and feed their experiences and learnings back into the courses and class discussions.

STI's current faculty leadership, especially as it pertains to the proposed Cloud Security post-baccalaureate certificate program, includes the following individuals:

Ryan Nicholson (ISE 6610)

Ryan started his information technology career as a system administrator for the US Department of Defense and quickly took on a more security-focused role as the field office's Network Security Officer, eventually becoming a cybersecurity lead auditor.

As the lead cybersecurity engineer for a major DoD cloud project, he constantly learned new and exciting methods to ensure that information systems in both an off- and on-premise environment can be adequately defended. He still continues providing support to this government contractor, but is now employed by SANS as a senior technical advisor for the Blue Team Operations curriculum team.

Ryan has earned a number of industry certifications, including GIAC's GDSA, GWAPT, GCIH, GSLC, and GSEC, Offensive Security's OSCP, ISC2's CISSP, EC Council's CEH and CFHI, and AWS' Certified Solutions Architect Associate.

Ryan earned his BS in Computer Science, with a concentration in Software Engineering, from Shippensburg University of Pennsylvania and his MS in Cybersecurity and Information Assurance from Western Governor's University.

Johannes Ullrich (ISE 6615)

Johannes Ullrich, one of only fourteen SANS Faculty Fellows, is currently responsible for the SANS Internet Storm Center (ISC) and the GIAC Gold program. In 2000, he founded DShield.org, which is now the data collection engine behind the ISC. His work with the ISC has been widely recognized, and in 2004, *Network World* named him one of the 50 most powerful people in the networking industry. Prior to working for SANS, Johannes worked as a lead support engineer for a web development company and as a research physicist. Johannes holds a PhD in physics from SUNY Albany and is based in Jacksonville, Florida. His daily Internet Storm Center podcast, which is downloaded tens of thousands of times per day, summarizes current security news in a concise format.

Eric Johnson (ISE 6620)

Eric Johnson is a co-founder and principal security engineer at Puma Security focusing on modern static analysis product development and DevSecOps automation. His experience includes application security automation, cloud security reviews, static source code analysis, web and mobile application penetration testing, secure development lifecycle consulting, and secure code review assessments.

Previously, Eric spent 5 years as a principal security consultant at an information security consulting firm helping companies deliver secure products to their customers, and another 10 years as an information security engineer at a large US financial institution performing source code audits.

As a Senior Instructor with the SANS Institute, Eric authors information security courses on DevSecOps, cloud security, secure coding, and defending mobile apps. He serves on the advisory board for the SANS Security Awareness Developer training program, delivers security training around the world, and presents security research at conferences including SANS, BlackHat, OWASP, BSides, JavaOne, UberConf, and ISSA.

Eric completed a BS degree in Computer Engineering and a MS in Information Assurance at Iowa State University, and currently holds the CISSP, GWAPT, GSSP-.NET, and GSSP-Java certifications.

Frank Kim (ISE 6630 and ISE 6650)

Frank Kim is the Founder of ThinkSec, a security consulting and CISO advisory firm, as well as a SANS Faculty Fellow and lead for both the SANS Management and SANS Cloud Security curricula, overseeing two dozen SANS courses in the two fastest growing curricula.

Previously, as CISO at the SANS Institute, Frank led the information risk function for the most trusted source of computer security training and certification in the world.

Frank is also the author and instructor of MGT512: Security Leadership Essentials for Managers, MGT514: Security Strategic Planning, Policy, and Leadership, and co-author of SEC540: Cloud Security and DevOps Automation.

Frank began his career as a developer in the early days of the Internet building applications and systems. When incidents would occur and vulnerabilities were discovered, Frank became the default point person for managing them. Though he did not realize it at the time, this was the beginning of his professional career in security. As his career progressed, he built teams both large and small to solve some interesting problems. This included forming a multi-million dollar security program at Kaiser Permanente as the Executive Director of Cybersecurity where he built an innovative security program to meet the unique needs of the nation's largest not-for-profit health plan and integrated health care provider with annual revenue of $60 billion, 10 million members, and 175,000 employees.

Frank holds a BA in Ethnic studies and a MBA from the University of California at Berkeley, is a frequent speaker at the annual RSA Conference, and has earned a number of professional certifications including: CISSP, GSLC, GCIH, GCIA, GCFA, GPEN, and GSSP.

A summary list of these Cloud Security post-baccalaureate certificate faculty is available in Appendix 3.

The full listing of STI faculty, in all programs, can be found on our website at https://www.sans.edu/academics/faculty.

Ongoing Pedagogy Training for Faculty:

Instructional pedagogy is an ingrained element of the SANS instructor developmental program, from which STI draws its faculty, and is reinforced during live teaching engagements and routinely during Curriculum Lead meetings. This instructional process is then continued on a recurring basis for new and current faculty members.

The SANS development and continuous assessment process ensures that persons eventually chosen to teach STI students demonstrate (1) mastery in the community of practice in which they instruct, and (2) highly rated and effective teaching practices. An equally important element of teaching quality at STI is that SANS' ongoing assessment processes enable the college to ensure that teaching faculty retain both a high degree of technical mastery and outstanding teaching skills on an ongoing basis.

During and after live teaching engagements, academic leadership and senior staff are provided with daily surveys of teaching effectiveness and subsequent aggregated reports. These include:

• Daily Reports, email to faculty and senior staff: With each day's survey scores from students, plus all written feedback comments, with highlights of positive and negative items. These daily reports enable overnight corrections to an adverse course experience or instructor performance.
• Quarterly summaries: Including heat maps for 'success rates' by course
• Instructor reports: Success rate charts for all instructors, and faculty "ranking" by feedback measures

These reports not only demonstrate the ongoing, continual assessments performed by faculty leadership, to include the Curriculum Leads (more below on this position), they further provide timely and recurring opportunities to reinforce best practices and institutional pedagogy. While these data are distributed and reviewed each day, analysis of the quarterly summaries and comparison reports generates recognition of longer-term issues, opportunities for further faculty development, and required corrective actions. Curriculum Leads, who act as the equivalent of "Department Heads" both for SANS and STI, play an important role in the management and development of other faculty. They are thought leaders individually, but they are also charged with the oversight of all courses within their curriculum, and meet as a group twice per year to review their curricula and pedagogy with each other. Individual faculty with identified performance

issues, as highlighted on these quality assessment reports, are engaged by Curriculum Leads for further investigation and instruction.

Finally, our Dean of Faculty, David Hoelzer, personally conducts quarterly in-person pedagogy refresher training. During this two-day session, held in the evenings after the completion of classes for the day, faculty receive instruction on best practices in teaching, presentation style, the conduct of labs, and engagement with students. This training is mandatory for new faculty, is open to all faculty, and occasionally involves a direct invitation to a current faculty member who, by virtue of the daily teaching assessment process described above, is deemed as able to benefit from refresher training. As a new initiative this year, these quarterly pedagogy training sessions are being supplemented by separate, additional sessions presented by Ed Skoudis, the Curriculum Lead for Penetration Testing. These supplemental sessions provide current instructors with expert and current practices for incorporating story-telling into their classroom presentation style.

LMS and Distance Education Training for Faculty:

The Cloud Security post-baccalaureate certificate program will use the same combination of live classroom and three distance learning modalities used in the STI graduate program that was commended for its "creative and forward looking teaching methodology" in the April 2018 Team Report to the Middle States Commission on Higher Education.

The three distance learning modalities available to students to complete the SANS technical course component are OnDemand, Live Online, and Simulcast. Students who use the OnDemand platform are given access to a learning management system with modules pre-loaded into the system and are also provided with printed course books containing written lectures and labs. Each module is a recording from an in-person course session. The learning management system allows students to revisit lectures and also complete quizzes to verify understanding. A recommended viewing schedule is included in course syllabi. Each STI course has a responsible faculty member, who in most cases is the same person recorded for the OnDemand course system. A teaching assistant referred to as a virtual mentor is available for all OnDemand courses to help answer student questions or assist with lab issues.

Faculty who teach through our OnDemand, Live Online and Simulcast modalities undergo specific training to help modify their teaching style to this format. STI faculty, who author all course content, are then supported by a dedicated team of online learning subject matter experts who maintain and monitor our learning management system. We engage this team of online learning experts to assist in both (1) the recording of distance learning course content and (2) online-specific methods to enable virtual student-faculty interactions, including when a class is Simulcast to remote students, employing an assistant in the room who participates in the class on behalf of distance students by flagging the instructors attention when questions or issues are addressed by virtual students. Members of the faculty have developed guidelines for best practices when teaching in our distance education formats. Thus, our design and delivery model distinguishes clearly between activities meant to be carried out by faculty, and those that are optimally conducted by dedicated, full-time staff.

All courses are reviewed annually for possible minor updates, and once every three years for major updates. During those reviews, faculty work with the LMS and distance learning subject matter experts to adjust both content and delivery in order to align with current best practices. STI uses this course evaluation process for ongoing internal and external effectiveness assessments to monitor (1) learner satisfaction, (2) applicability and value of material being taught, (3) alignment of methods with the community of practice, and (4) faculty performance. During or immediately following each learning experience, students are asked to provide feedback on the faculty and the course content, and these evaluations are available to instructors who may review them each evening. Assessment analysts aggregate the data from the evaluations and feedback after every learning event, creating an event report which is reviewed by important stakeholders, including the program directors, members of the Curriculum, Academic, Faculty and Student Affairs Committee, and STI's President. Potential problems, generally identified by scores falling below a threshold in one or more areas are investigated by members of the Curriculum, Academic, Faculty and Student Affairs Committee with responsibility for overseeing curriculum within a cognate discipline. When required, this allows for real-time remediation of any shortfalls in pedagogy or delivery of content.

For evidenced-based best practices for faculty use of our learning management systems and distance education, see Appendix 2. "Evidence of Compliance with the Principles of Good Practice (outlined in COMAR 13B02.03.22C)."

J. Adequacy of Library Resources (outlined in COMAR 13B.02.03.12).

The challenges of information security are constantly evolving, and excellence in performance demands continuous monitoring of changes in threats, technology, and practices. SANS conducts an extensive research program that helps STI students and alumni maintain their edge in security. The SANS Resource Center is a compilation of thousands of original research papers, security policies, and security notes, along with a wealth of unique network security data. Supplemented by an online research library subscription and other SANS information services, our current and future students have continuous access to the following list of primary resources:

- The SANS Information Security Reading Room, which contains more than 2,000 original research studies, not available from any other source, in 76 knowledge domains relevant to the study of information security. They are downloaded more than a million times each year.
- Free and unlimited access to EBSCO's "Computers and Applied Sciences (Complete)" database. EBCSO is the leading provider of online research databases, e-journals, magazine subscriptions, e-books, and discovery services of all kinds. This full-text database covers computing, technology and engineering disciplines, and contains 650 active full-text journals and magazines, 520 active full-text peer-reviewed journals, 320 active full-text peer-reviewed journals with no embargo, and 410 active full-text and indexed journals.
- The SANS Security Policy Collection, which contains model security policies developed by major corporations and government agencies. The collection contains about 35 policies and grows as new security issues arise and policy templates are needed.

- The SANS Technology Institute's Cyber Research page, which provides access to exemplary graduate-level research papers, group projects, and presentations that cover a wide variety of topics of practical and academic relevance that have real-world impact and often provide cutting-edge advancements to the field of cybersecurity knowledge.
- The SANS Top-20 V7, a consensus list of vulnerabilities that require immediate remediation. The list is the result of a process that brought together dozens of leading security experts.
- The SANS Newsletter Collection, which helps keep students up to date with the high-level perspective of the latest security news.
- The Security Glossary, which is among the largest glossaries of security terms available on the Internet. It was developed jointly by SANS and the National Security Agency and provides authoritative definitions of many of the specialized terms students will encounter.
- The SANS Collection of Frequently Asked Questions about Intrusion Detection, available at contains 118 authoritative discussions of the primary topics that arise when planning and implementing intrusion detection technologies. The collection is available at http://www.sans.org/security-resources/idfaq/.
- The SANS Internet Storm Center Handler Diaries and Archives, which contain contemporaneous analyses of new attacks that are discovered on the Internet. The archives constitute an extraordinary research asset because of the depth of the analysis and the currency of the topics covered. They also provide SANS students with access to raw data, summaries, and query facilities to analyze malicious Internet traffic records. This is a rich data source for advanced security research projects that analyze attack patterns and how fast worms and other attacks spread through the Internet.
- SANS Web Briefings held several times a month that feature SANS faculty and other security experts providing up-to-date web briefings for SANS alumni on new threats seen at the Internet Storm Center, new technologies that are emerging, and analysis of security trends.

K. Adequacy of Physical Facilities, Infrastructure, and Instructional Equipment

This program will be offered in combinations of various online modalities and, in normal times, at residential institutes. More than 400 residential institutes are routinely available, under normal travel conditions, to Cloud Security students each year with a cumulative capacity of more than 40,000 students.

Additionally, the Cloud Security program draws on SANS's online technology that currently serves more than 18,000 students each year which is not capacity-constrained and is available globally and around-the-clock.

Finally, building upon our ten years of experience at delivering synchronous and asynchronous online education, we have improved and expanded our online delivery capabilities to include our new "Live Online" format, which essentially replicates a residential learning experience via a 1-, 2-, 3-, or 6-week format. Thus, the proposed program will easily be accommodated in the existing in-person training programs. Currently scheduled live courses described in this curriculum can be found online here.

L. Adequacy of Financial Resources with Documentation (outlined in COMAR 13B.02.03.14)

1. Complete Table 1: Resources (pdf) and Table 2: Expenditure(pdf). Finance data(pdf) for the first five years of program implementation are to be entered.
2. Provide a narrative rationale for each of the resource categories.

Table 1: RESOURCES

Resource Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Reallocated Funds	0	0	0	0	0
2. Tuition/Fee Revenue (c + g below)	210000	480000	435000	472500	622500
a. Number of F/T Students	20	32	33	37	37
b. Annual Tuition/Fee Rate	10500	10500	10500	10500	10500
c. Total F/T Revenue (a x b)	225000	367500	367500	388500	388500
d. Number of P/T Students	0	0	0	0	0
e. Credit Hour Rate	0	0	0	0	0
f. Annual Credit Hour Rate	6	6	6	6	6
g. Total P/T Revenue (d x e x f)	0	0	0	0	0
3. Grants, Contracts & Other External Sources	0	0	0	0	0
4. Other Sources	0	0	0	0	0
TOTAL (Add 1 – 4)	225000	367500	367500	388500	388500

Table 2:
EXPENDITURES

Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b + c below)	11250	24000	21750	23625	31125
a. # Sections offered	N/A	N/A	N/A	N/A	N/A
b. Total Salary	6750	14400	13050	14175	18675
c. Total Benefits	4500	9600	8700	9450	12450
2. Admin. Staff (b + c below)	16800	42000	42000	42000	58800
a. # FTE	0.2	0.5	0.5	0.5	0.7
b. Total Salary	12000	30000	30000	30000	42000
c. Total Benefits	4800	12000	12000	12000	16800
3. Support Staff (b + c below)	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
4. Equipment	0	0	0	0	0
5. Library	0	0	0	0	0
6. New or Renovated Space	0	0	0	0	0
7. Other Expenses	90000	147000	147000	155400	155400
TOTAL (Add 1 – 7)	118050	213000	210750	221025	245325

Finance Data: Narrative

Table 1: RESOURCES

1. Re-allocated Funds
   Narrative: Analyze the overall impact that the reallocation will have on the institution, particularly on existing programs and organizations units.
   N/A

2. Tuition and Fee Revenue
   Narrative: Describe the rationale for the enrollment projections used to calculate tuition and fee revenue.
   STI is currently recruiting 20-30 new post-baccalaureate certificate students per month, with approximately one-third typically going into our Penetration Testing program, one-third into our Incident Response program, and the remaining one-third split into the Cyber Defense, Cyber Core, and Industrial Control systems programs. Thus, it is our more narrowly-focused post-baccalaureate certificate programs which attract the greatest number of new students; however it is also true that penetration testing and incident response are required functions across

many industries. We believe that market and industry pressures will similarly elevate the attractiveness of this advanced, multi-faceted post-baccalaureate certificate program to eventually be nearly on par with our two largest certificate programs.

The tuition projection for Year 1 assumes the Cloud Security program admits 20 full-time students during the course of the year, each of whom pay $5,250 per course. Currently, our graduate students complete an average of 2 courses per year, supporting an effective annual tuition of $10,500 per year per student.

In Year 2, we assume that the rate of admission to the program will drop slightly, after attracting a "backload" of prospective students, to admit 15 new students. As most of our post-baccalaureate certificate students take roughly two years to complete their programs, this second year of growth is purely additive. Also, the two-year retention rate for post-baccalaureate certificate students is approximately 85%. This retention rate is factored into the prior year's admitted number, and is added to the current year's admitted number to combine to a total number of students for that given year. Thus, the net total number students in year 2 is effectively 32.

For years 3, 4, and 5 we project 20 new students per year. Applying the same logic presented above, this leads to a total effective student counts of 33, 37, and 37, respectively. We believe expectations for this growth are reasonable because we will be able to expand the offering of the program to students from other states via our online modalities.

3. Grants and Contracts
   Narrative: Provide detailed information on the sources of funding. Attach copies of documentation supporting funding. Also, describe alternative methods of continuing to finance the program after outside funds cease to be available. N/A

4. Other Sources
   Narrative: Provide detailed information on the sources of the funding, including supporting documentation. N/A

5. Total Year
   Narrative: Additional explanation or comments as needed. N/A

Table 2: EXPENDITURES

Faculty

Cloud Security students may receive instruction live in-classroom or online, depending on the course and their own choices. When they attend live in-classroom, they join a class already being taught by STI faculty to other students, and the Cloud Security students typically represent no more than a 5% - 10% increase in the total students in any given classroom. When they choose to take the course online, no additional faculty are required and, similar to live classes, Cloud Security students represent only a small fraction of those students being taught by the existing group of subject-matter experts and teaching assistants and at any given time. Therefore, we do not anticipate any increase in the number of faculty required to teach Cloud Security students, either live or online. In addition, the cost associated with the faculty and subject-matter experts/teaching assistants who teach these students is embedded into the payments associated with the Memorandum of Understanding between STI and SANS, at an effective rate of 5% of tuition revenue. Thus, for the sake of clarity, we have estimated a proportional cost for faculty salary and benefits as a percentage of total course load increase which is expected due to the creation of this new post-baccalaureate certificate program.

Administrative and Support Staff

The STI graduate programs currently operate at a ratio of students to administrative staff ratio of 150:1 in cases where a student advisor's workload consists entirely of post-baccalaureate certificate students (as compared to those advisors who also, or only, work with master's students). Average salary and benefit information is reflective of our current cost experience and market expectations.

Equipment, Library, New and/or Renovated Space

The Cloud Security program will not require any additional equipment, library facilities, or any new and/or renovated space. We have ample capacity in our existing facilities, residential institutes, online platform capacity, and offices.

Other Expenses

As described elsewhere, a core design element of the SANS Technology Institute are the Memoranda of Understanding signed with our parent, the SANS Institute, and a related entity, GIAC Corporation, that allow STI to select and pay for many costs on a variable, per-student basis. The Cloud Security program will also benefit from this financial arrangement. The financial projections assume the same mix of payments that STI incurs today per student, as recently reviewed by the Middle States evaluation team during our re-accreditation study.

M. Adequacy of Provisions for Evaluation of the Program (outlined in COMAR 13B.02.03.15).

Continuous, closed-loop evaluation has been the hallmark of STI programs since the school was established. STI employs a three-level evaluation program completely embedded in the curriculum. The 2018 Middle States Evaluation Team commended this evaluation methodology: "SANS Technology Institute should be commended for the fact that its curriculum automatically embraces learning outcomes and program outcomes."

1. **Every day, in every STI class, every student is expected to complete an evaluation of the teaching effectiveness, the currency and value of the course material, and the quality of the labs, exercises, and other aspects of their learning experience.** Their forms are processed by an evaluation team and results are delivered by 6:30 the following morning to STI's president and senior staff. The course faculty often reviews the forms the evening of the day they are completed. The evaluation team follows up on all strong concerns and, in several cases when a faculty member was clearly struggling, has replaced the teacher by noon the next day based on the evaluations. In addition, the evaluation team compiles and feeds course content suggestions or concerns to the course author for consideration or inclusion in the annual (or sometimes more frequent) course updates. Data on labs or other technology go to the appropriate teams for continuous or major product improvement. This evaluation system is also used in Live Online and Simulcast distributed learning modalities. For On-Demand, the evaluation cycle is based on module completion rather than days, but the system functions identically and in fact responses are easier to process because entries are already in digital form when submitted.

2. **Evaluation of course-level student outcomes uses reliable measures of mastery** not subject to variability associated with individual faculty members' understanding of the course outcomes. Each course has an associated examination that is recognized as a widely accepted and valued way to validate mastery of the course outcomes. For example, all Cloud Security students are required to complete a course in which they learn incident handling techniques, common attack techniques, and the most effective methods of stopping intruders using those attack techniques. The exam and certification associated with this course is called the Global Cybersecurity Incident Handler (GCIH) test and certification. The value of this exam is demonstrated by the fact that each year employers pay for more than 11,000 of their employees and job candidates to take this course and sit for the GCIH exam (pass rate of approximately 70%). The acceptance of the exam is validated by the U.S. Department of Defense (DoD) directive that names GCIH certification as proof that a DoD employee or contractor is capable of taking on the highest of three levels of technical cybersecurity roles in DoD. The GIAC certifications used for evaluating student mastery of course objectives are updated using a large-scale job-task analysis that interviews practitioners at least every three years. This process, along with the psychometric assessments that shaped question assessment, is subjected to regular review by the

American National Standards Institute. GIAC exams increasingly include hands-on test questions where students can demonstrate they can use what they learned.

3. **To evaluate program outcomes,** STI tracks all graduates and asks them (and when possible, their employers) annually for feedback on how well the program worked for them and how it might be improved. Additionally, STI has implemented its formal Learning Outcomes Assessment Plan, as endorsed by the MSCHE evaluation team. Under this plan, each post-baccalaureate certificate program undergoes a formal review by an evaluation team comprised of subject matter experts every four years. This review process will ensure alignment of (1) course outcomes to program learning objectives, of (2) program learning objectives to any capstone requirements, and of (3) both program learning objectives and capstone requirements to a survey of industry requirements.

N. Consistency with the State's Minority Student Achievement Goals (outlined in COMAR 13B.02.03.05 and in the State Plan for Postsecondary Education).

COMAR 13B.02.03.05 calls for higher education institutions to focus on equal opportunity concerns and on the expansion of educational opportunities and choices for minority and educationally disadvantaged students. The SANS Technology Institute collaborates with our SANS CyberTalent partner (https://www.sans.org/cybertalent/) to provide exactly those opportunities for Maryland residents. CyberTalent provides not only the Maryland Cyber Workforce Academy (https://www.sans.org/cybertalent/cyber-workforce-academy-maryland), but also routinely provides Diversity Cyber Academies that are open to Maryland residents. These Diversity Academies are intensive, accelerated training programs that provide SANS world class training and GIAC certifications to quickly and effectively launch careers in cybersecurity. SANS CyberTalent Immersion Academies are 100% scholarship-based and no cost to participants. Upon graduating from a Diversity Academy and gaining employment in the cybersecurity field, where employers routinely provide extensive training and education support, the SANS Technology Institute ensures that all Diversity Academy graduates are aware that their prior immersion training is potentially eligible for waiver into any of our undergraduate or graduate programs, allowing the student to enter with advanced standing and reduced program cost, and that we work with a wide array of employers to ensure that continuing education is available at no cost to the employee whenever possible.

O. Relationship to Low-productivity Programs Identified by the Commission

Not applicable.

P. If Proposing a Distance Education Program, Please Provide Evidence of the Principles of Good Practice (outlined in COMAR 13B.02.03.22C).

See Appendix 2 for the evidence that this program complies with the Principles of Good Practice.

Appendix 1. Contracts with Related Entities

The SANS Technology Institute (STI) as an educational institution is an independent yet symbiotic and related entity to the much larger SANS and GIAC organizations. As such, it represents a unique integration of existing and purpose-built educational elements from SANS and GIAC, augmented with additional elements that are specific to STI:

- **STI as an independent subsidiary** – STI is an independent but wholly owned subsidiary of SANS, with its own board and administrative staff. As an organization, it is designed to include those full-time personnel who directly serve the admissions and ongoing management and educational servicing of students, while outsourcing most other functions to SANS and GIAC, which operate at scale and may deliver those services (including human resources, finance, and technology systems) to STI at levels or costs that would otherwise be unachievable by an institution with fewer than 1,000 students. This unique combination of dedicated staff and flexible access to world-class scale and quality systems is a key enabler for STI's students to access world-class faculty and educational content from an otherwise small institution.

- **STI's faculty come from SANS** – STI's faculty is comprised of and appointed from the 85 individuals who have achieved the status of being "SANS Certified Instructors," an industry-recognized demarcation of technical achievement practiced in the field, superior teaching effectiveness, capacity to engage students as exemplified in the classroom and online, and successful completion of a competitive development process that employs both student and peer-faculty feedback to prove that the instructors possess these qualities. Among the faculty are people who are called upon to investigate attacks on the U.S. government and the country's largest commercial enterprises, who are entrusted to teach practitioners of cybersecurity at the highest and most sensitive (classified) levels, and who through their professional practice and research advance our understanding of cyber threats and potential remediation, and then transmit that knowledge forward to our students and the larger community. Even beyond their superlative technical abilities, our faculty members have skills as teachers that truly set them apart and allow them to impart sometimes dense technical lessons with enthusiasm, applicable real-world examples, and charismatic engagement. While a handful of faculty members serve in full-time teaching and research roles, most are scholar-practitioners who teach less than full-time for the school so that they can engage in the practice of cybersecurity, keep their skills advanced and current, and feed their experiences and learning back into the courses and class discussions.

- **STI's programs designed by STI faculty** – STI's academic programs were designed by the faculty in order to optimally achieve their stated learning outcomes. For each program, the faculty responsible for program design built out the educational content from three distinct sources:
    - **SANS Technical and Management Courses** – SANS maintains the world's largest and most-respected catalog of 36-50 seat-hour courses in cybersecurity, ranging from broad survey courses in cyber defense to highly advanced and specialized penetration testing and digital forensics courses. Each program includes a subset of SANS courses relevant to achieving that program's learning

outcomes, including the availability of elective courses. In addition, STI students may avail themselves of all the opportunities at different times and locations throughout the United States (and world) that the courses are offered live and taught by STI faculty, or they may also take the opportunity to take the very same course presented online by SANS, which transforms the best live performance by an STI faculty member into the online version of the course, complete with the same labs and access to subject-matter experts online. STI thereby offers an extraordinarily broad set of choices for students to tailor their program schedule to fit within their work and personal lives.

- **GIAC Certification Exams** – STI's faculty deploy various world-class, industry-proven GIAC examinations to validate the learning achieved by each student in a SANS technical course. GIAC exams result from an exam development effort that far exceeds the typical requirements for college-level examinations. That effort includes job task analyses to ensure relevance and psychometric reviews that in turn ensure appropriate difficulty and rigor. Many of the GIAC exams deployed in STI's programs are themselves ANSI-certified for quality and robustness. The use of those exams enables STI's programs to ensure that students are assessed fairly and that their performance and grades are constantly level-set against the performance of other industry professionals taking the same exam.
- **STI-specific educational elements and courses** – STI's faculty creates many additional elements to augment the programs with written security memos and research, oral presentations, group projects, and other experiences designed to require high-level integrations of learning.

Two Memoranda of Understanding (MOU) define the business relationships between STI, its SANS parent, and its sister organization the Global Information Assurance Certification (GIAC) organization. Those MOUs are reproduced in full below.

Memorandum of Understanding
between
The SANS Technology Institute ("STI")
and
The Escal Institute of Advanced Technologies ("SANS")

Agreement Published Date: January 1st, 2018
Agreement Period of Performance: January 1st, 2018 – December 31st, 2025

Purpose

The purpose of this Memorandum of Understanding ("MOU") is to establish a cooperative partnership between the SANS Technology Institute (STI) and the ESCAL Institute of Advanced Technologies, Inc/dba/SANS Institute (SANS). This MOU will:

- outline services to be offered by SANS to STI;
- quantify and measure service level expectations, where appropriate;
- outline the potential methods used to measure the quality of service provided;
- define mutual requirements and expectations for critical processes and overall performance;
- strengthen communication between the provider of administrative services (SANS) and its enterprise customer (STI);
- provide a vehicle for resolving conflicts.

Vision

SANS will provide a shared business environment for the STI enterprise. The business environment will continuously enhance service, compliance and productivity to STI's employees, students and core administrative practices. The primary goals for the MOU include:

- **Integrate** people, processes, and technology to provide a balanced service level to all customers. Create a collaborative environment where trusted relationships and teamwork are encouraged between administrative services, departmental staff, faculty, students and suppliers to further the enterprise's goals.
- **Leverage** human resources, institutional knowledge, developing skill sets, and technology in an effort to continuously improve service and productivity for all services provided. Create an organizational structure that balances STI's strategic and tactical efforts to promote efficiencies.
- **Mitigate** risk to the STI enterprise by focusing on compliance requirements and understanding the impact these requirements have on productivity and student services. Develop an integrated organizational structure that will promote the consistent interpretation and enforcement of policies, procedures, local, state and Federal laws and regulations throughout the enterprise.

Mission

Through various SANS educational and administrative service units, provide business activities dedicated to operational and student service excellence to the STI enterprise so that core STI staff can focus on the academic components of their mission to educate managers of information security groups and technical leaders who direct information security programs.

Scope

The SANS Institute will provide access for STI students, in all delivery modalities, to the Technical courses offered by the SANS Institute that are a part of STI's course curricula, including, Course Maintenance, Presentation of this course material , and Educational Residency services for the SANS Technology Institute. The SANS Institute shall provide policy-compliant management of Accounting & Finance, Bursar & Registration, Human Resource, Marketing, and Information Technology infrastructures for STI.

Hours of Operations

Typical staffed hours of operation for the SANS activities are 9:00 – 5:00 Monday-Friday, with the exception of approved holidays. Working hours may be adjusted due to system/power outages, emergency situations, or disaster. Through the use of technology, it is expected that many of the services provided will be available to STI students and employees on a 24-hour basis.

Service Expectations

SANS and STI agree to the service expectations and working assumptions listed below. These service expectations are meant to monitor the more critical elements of the services provided and are not meant to reflect the comprehensive services offered by SANS. The productivity indicators reflected below are not listed in any order of priority.

Accounting and Finance

Process	Service Expectation	Service Metric
Accounts Receivable	Remittances produced in the form of check, EFT, or wire.	Payment schedule is set up for a daily cycle and reporting available daily.
Payment accuracy	All payments made will be for approved and legitimate services/products	Audits of vendor transactions will show evidence of 100% three-way match.
Employee travel and expenses are reimbursed.	Protect financial outlays made by employees.	Reimbursements are made within a 30-day timeframe.
Financial reporting	Financial reporting is done on time and in accordance with the same audited accounting principles used by SANS.	All MSCHE, federal and internal reporting deadlines will be met on time.
Audit of records	Annual audits will be performed	Annual audit performed on the Financial Statements by an independent external auditor

Bursar & Registration

Process	Service Expectation	Service Metric

Cashier Function	Process payments and distribute revenue to appropriate departments	Payments will be processed within 24 hours of receipt, and revenue distributed on a monthly basis

Human Resources

Process	Service Expectation	Service Metric
Benefits	Provide benefits which are in the best interest of the employees and employer	Annual survey of employees will show that major benefits of interest are being adequately provided
Payroll	Assure timely payroll and employee reviews	All bimonthly payrolls will be made on the 15th and final days of the month
HR services	Manage HR service to ensure receipt by employees	HR services are provided for in a timely manner as measure in annual survey and changes are communicated and enforced

Marketing

Process	Service Expectation	Service Metric
Brand Awareness	Create awareness of STI programs within the information Security Community	SANS will facilitate access to its customer list and will routinely conduct cross-branding to assist with market awareness of STI graduate programs
Technical Expertise	SANS will provide the creative content assistance, graphic editing, and industry expertise required to allow for the execution of STI recruitment campaigns	Generalized STI marketing campaigns are made operational via the availability of a centralized SANS marketing staff

Information Technology

Process	Service Expectation	Service Metric
Digital learning environment	Create and maintain a leading edge digital environment for learners	Learner surveys consistently scoring above 4 on a scale from 1 to 5, plus recommender percentage greater than 90%.
Technology infrastructure	Provide transaction platforms to support student course registration and other services	Annual surveys of students to reflect adequacy of transaction processes

Technical Course Maintenance & Presentation

Process	Service Expectation	Service Metric
Currency of content	Make available for use by STI Faculty any and all technical content developed by the SANS Institute	Content is reviewed at least semi-annually for currency with existing malicious capabilities and mitigation theory and strategy

Quality of content and presentations	Assist through all means necessary and available the delivery of STI faculty and lab instruction in a high-quality fashion	SANS Institute will make available all performance ratings derived from students on STI courses or faculty

Educational Residency

Process	Service Expectation	Service Metric
Conference services	Provide hotel, classroom technology, refreshment and other services that promote an unencumbered learning environment for students	Conference services provided will maintain an average rating of at least 4 out of 5 on daily student surveys

Service Constraints

- ***Workload -*** Increases in workload, such as back log due to power outages or fiscal year end closing, may result in temporary reduction of service level delivery.
- ***Conformance Requirements -*** Finance policy changes and Internal Revenue regulations may alter procedures and service delivery timeframes.
- ***Dependencies -*** Achievement of the service level commitment is dependent upon student and employee compliance with the policies and procedures of the STI enterprise.

Terms of Agreement

The term of this agreement is January 1, 2018 - December 31, 2025. This Agreement may be cancelled only by STI, at its sole discretion.

Periodic Quality Reviews

STI and SANS will jointly conduct periodic reviews of individual SANS administrative support unit performance against agreed-upon service level expectations. The agenda for these reviews should include, but is not limited to:

- service delivery since the last review
- major deviations from service levels
- conflicts or concerns about service delivery
- planned changes to improve service effectiveness
- provide feedback from student and employees
- annual customer satisfaction surveys

STI and SANS will also regularly assess customer satisfaction and will use the results as a basis for changes to this Agreement.

STI's Executive Director and the SANS administrative service unit lead will meet annually.

Service Level Maintenance

This Agreement will be reviewed on an ongoing basis and updated as needed. Revisions may become necessary due to changing service needs, modifications to existing services, addition of services, significant variations from agreed upon-service levels, or unanticipated events.

Issue Resolution

- If either party identifies a substantive breach of responsibility, or other problem that requires resolution prior to the next periodic review, the operating level managers of both parties will engage in a joint effort of understanding and rectification of the issue. In the event this remedial effort fails, either party can raise the issue to the executive levels of both parties.

Payment Terms and Conditions

For services provided, STI will pay SANS according to the following schedule:

- STI will pay SANS $1,500 for each instance when an STI student registers for a full SANS class as part of an STI course, regardless of the chosen delivery modality (live event or online), and as subject to the schedule found at Appendix A for partial or non-standard classes which comprise only 1-credit events within the STI curriculum.
- STI will pay amounts to SANS, monthly in arrears, to reflect any directly allocated expenses by SANS personnel in support of STI business according to this services agreement (specifically including the result of any time allocation procedures as determined by SANS accounting department)
- STI will pay an amount to SANS, monthly in arrears, to reflect its pro-rata share of SANS' otherwise unallocated costs for Accounting & Finance, Bursar, Human Resource, Marketing and Information Technology, and related administrative services, in proportion to its share of revenue relative to SANS revenue also sharing in this services pool.

Agreed to on behalf of STI:	Agreed to on behalf of SANS:
_____	_____
Eric A. Patterson Executive Director SANS Technology Institute	Peggy Logue Chief Financial Officer SANS Institute

Date: Date:

Appendix A: Schedule of SANS Courses Subject to, or Exempt From, the Payment Terms Described in this Agreement

STI Course	SANS Course	Payment Amount
ISE 5101	SEC 401	$1,500
ISM 5101	MGT 512	$1,500
ISE/M 5201	SEC 504	$1,500
ISE/M 5300	MGT 433	$ 500
ISM 5400	MGT 514	$1,500
ISE 5401	SEC 503	$1,500
ISE/M 5500	N/A	$ 0
ISE 5600	MGT 514 (Day 4)	$ 500
ISM 5601	LEG 523	$,1500
ISE/M 5700	N/A	$ 0
ISE/M 5800	MGT 525	$1,500
ISE/M 5900	N/A	$ 0
ISE/M 6001	SEC 566	$1,500
ISE/M 6100	N/A	$ 0
ISM 6201	AUD 507	$1,500
ISE/M 6215	SEC 501	$1,500
ISE 6230	SEC 505	$1,500
ISE 6235	SEC 506	$1,500
ISE 6240	SEC 511	$1,500
ISE/M 6300	NetWars Cont	$ 0
ISE 6315	SEC 542	$1,500
ISE 6320	SEC 560	$1,500
ISE 6325	SEC 575	$1,500
ISE 6330	SEC 617	$1,500
ISE 6350	SEC 573	$1,500
ISE 6360	SEC 660	$1,500
ISE 6400	DFIR NetWars Cont	$ 0
ISE 6420	FOR 500	$1,500
ISE 6425	FOR 508	$1,500
ISE 6440	FOR 572	$1,500
ISE 6450	FOR 585	$1,500
ISE 6460	FOR 610	$1,500
ISE 6515	ICS 410	$1,500
ISE 6520	ICS 515	$1,500
ISE 6615	DEV 522	$1,500
ISE 6715	AUD 507	$1,500
ISE 6720	LEG 523	$1,500
RES 5500	N/A	$ 0

RES 5900	N/A	$ 0

SANS Technology Institute-GIAC Memorandum of Understanding

Agreement Published Date: January 1, 2018
Agreement Period of Performance: January 1st, 2018 – December 31st, 2025

Contents

Purpose

This Memorandum of Understanding ("MOU") revises and supersedes any previously signed agreement between the SANS Technology Institute (STI) and Global Information Assurance Certification (GIAC). This MOU:

- outlines services to be offered and working assumptions between STI and GIAC;
- quantifies and measures service level expectations;
- outlines the potential methods used to measure the quality of service provided;
- defines mutual requirements and expectations for critical processes and overall performance;
- strengthens communication between the provider of assessment services (GIAC) and its enterprise customer (STI);
- provides a vehicle for resolving conflicts.

Vision

GIAC will provide student assessment services for the STI enterprise. The primary goals for the MOU include:

- **Provide** access to high quality services for students, community and faculty, while ensuring identity and examination integrity in a secure and test-friendly environment.
- **Provide** meaningful certification services to students while promoting their academic, career and personal goals.
- **Demonstrate** that STI students can contribute to the knowledge base in information security and can communicate that knowledge to key communities of interest in information security.

Mission

Through various service units, GIAC provides assessment activities dedicated to operational and student service excellence to the STI enterprise so that core STI staff can focus on the academic components of their mission to educate managers of information security groups and technical leaders who direct information security programs.

Scope

GIAC shall provide job task analysis-based assessments in the form of proctored certification exams.

Hours of Operations

Through the use of technology and GIAC directed service providers, it is expected that assessment services provided will be available to STI students on a 24-hour basis.

Service Expectations

STI and GIAC agree to the service expectations and working assumptions listed below. These service expectations are meant to monitor the more critical elements of the services provided and are not meant to reflect the comprehensive services offered by GIAC. The productivity indicators reflected below are not listed in any order of priority.

Service Constraints

- ***Scheduling of Capstone Examinations -*** The scheduling of the capstone GSE and GSM examinations will occur in conjunction with appropriate STI administrative staff and will adequately account for the number of students requiring a given capstone examination during each year.
- ***Conformance Requirements -*** ANSI policy changes may alter procedures and service delivery timeframes.
- ***Dependencies -*** Achievement of the service level commitment is dependent upon student and faculty compliance with the policies and procedures of GIAC.

Terms of Agreement

The term of this agreement is January 1, 2018 - December 31, 2025. This Agreement may be cancelled only by STI, at its sole discretion.

Periodic Quality Reviews

STI and GIAC will jointly conduct periodic reviews of individual GIAC assessment unit performance against agreed-upon service level expectations. The agenda for these reviews should include, but is not limited to:

- service delivery since the last review
- major deviations from service levels
- conflicts or concerns about service delivery
- planned changes to improve service effectiveness
- provide feedback from student and employees
- annual customer satisfaction surveys

STI and GIAC will also regularly assess customer satisfaction and will use the results as a basis for changes to this Agreement.

STI's Executive Director and the Director of GIAC will meet annually.

Service Level Maintenance

This Agreement will be reviewed on an ongoing basis and updated as needed. Revisions may become necessary due to changing service needs, modifications to existing services, addition of services, significant variations from agreed upon-service levels, or unanticipated events.

Issue Resolution

- If either party identifies a substantive breach of responsibility, or other problem that requires resolution prior to the next periodic review, the operating level managers of both parties will engage in a joint effort of understanding and rectification of the issue. In the event this remedial effort fails, either party can raise the issue to the executive levels of both parties.

Payment Terms and Conditions

For services provided, STI will pay GIAC according to the following schedule:

- STI will pay GIAC $325 each time a student pays for a GIAC exam as part of their program of studies, or when they pay tuition or pay for credit hours for a course in which they will take a GIAC certification exam.
- STI will specifically pay GIAC $1000 each time a student pays for a GSE or GSM exam as part of their program of studies.

Agreed to on behalf of STI:	Agreed to on behalf of GIAC:
_____	_____
Eric A. Patterson Executive Director SANS Technology Institute	Scott Cassity Executive Director GIAC
_____	_____
Date	Date

Appendix 2. Evidence of Compliance with the Principles of Good Practice (outlined in COMAR 13B02.03.22C)

The proposed program uses the same combination of live classroom and three distance learning modalities used in the STI graduate program that was commended for its "creative and forward looking teaching methodology" in the April 2018 Team Report to the Middle States Commission on Higher Education. That report also noted that all modalities resulted in equivalent scores, with the distance learning modalities earning slightly higher scores in several tougher courses where students needed more time to absorb (and review) the material.

The three distance learning modalities available to students to complete the SANS technical course component are OnDemand, Live Online , and Simulcast. Students who use the OnDemand platform are given access to a learning management system with modules pre-loaded into the system and are also provided with printed course books containing written lectures and labs. Each module is a recording from an in-person course session. The learning management system allows students to revisit lectures and also complete quizzes to verify understanding. A recommended viewing schedule is included in course syllabi. Each STI course has a responsible faculty member, who in most cases is the same person recorded for the OnDemand course system. A teaching assistant referred to as a virtual mentor is available for all OnDemand courses to help answer student questions or assist with lab issues.

The Live Online learning modality is conducted online with established course meeting times led by an instructor – typically twice per week for up to eight weeks – through a learning management system that allows for direct interaction with the instructor and other course participants. Each course session is recorded for students to review previously covered material, or to view if they miss a session.

The Simulcast delivery modality allows students to participate in a course being offered through the in-person modality, but from their location of choice, enabled through a digital learning management system. Students meet during the same time the in-person course meets. They can participate in classroom lectures by seeing and hearing the instructor, in addition to asking questions and participating in classroom discussion.

If a student chooses a distance learning modality, that experience is comprised of the very same coherent, cohesive, and academically rigorous curriculum used for the course when taken via our traditional residential institute-based, in-person instructional format. The faculty member assigned to the STI course reviews student performance on exams and papers and assigns a grade at the end of the course.

(a) Curriculum and instruction

(i) A distance education program shall be established and overseen by qualified faculty.

When implemented for distance education, the courses are converted from the live in-class courses in consultation with and under the direction of the faculty,

(ii) A program's curriculum shall be coherent, cohesive, and comparable in academic rigor to programs offered in traditional instructional formats.

If a student chooses a distance learning modality, that experience is comprised of the very same coherent, cohesive, and academically rigorous curriculum used for the course when taken via our traditional residential institute-based, in-person instructional format. The faculty member who oversees the STI course reviews student performance on exams and papers and assigns a grade at the end of the course. Moreover, the outcomes achieved by students employing STI's distance learning modalities are demonstrably equivalent to those achieved by students who attend live in-person courses.

The working group for the 2014 Substantive Change Request, whereby STI was approved by Middle States to deliver more than 50 percent of our credit via distance modalities, reported:

> "A 2013 study of all certification exam results provided evidence that the exam scores achieved on these standardized certification exams were not statistically different when comparing delivery modalities – such as whether the course instruction was taken via our traditional, live instructional format or via either our OnDemand or Live Online instructional modalities....A similar analysis was conducted using calendar year 2014 exam outcomes. Results from the analysis were consistent with trends noticed in the 2013 study of all certification exams. On average, students who enrolled in a distance education course in 2014 performed slightly better on exams than students who enrolled in in-person courses."

To update these assessments, the working group once again compared the GIAC scores of students who had taken their classes live versus those who took their classes through STI's OnDemand modalities, and once again found the measured learning outcomes to be the same among both groups (Table A4.1).

Table A2.1. Comparison of GIAC Exam Score Performance via Live and OnDemand Modalities, 2014-2017

Modality	Overall Score	Master's Program	Certificate Program
Live Class	84.6	86.6	82.4
OnDemand Class	83.7	87.2	82.0

(iii) A program shall result in learning outcomes appropriate to the rigor and breadth of the program.

The learning outcomes of the courses included in the Applied Cybersecurity Program have been validated by the faculty as appropriately rigorous and broad and are integrated into each course and measured quantitatively through ANSI-standardized certification exams for the three advanced courses and through integrated testing in each of the other courses.

(iv) A program shall provide for appropriate real-time or delayed interaction between faculty and students.

A teaching assistant referred to as a virtual mentor is available for all OnDemand courses to help answer student questions or assist with lab issues.

The Live Online learning modality is conducted online with established course meeting times led by an instructor – typically twice per week for up to eight weeks – through a learning management system that allows for direct interaction with the instructor and other course participants. Each course session is recorded for students to review previously covered material, or to view if they miss a session.

The Simulcast delivery modality allows students to participate in a course being offered through the in-person modality, but from their location of choice, enabled through a digital learning management system. Students meet during the same time that the in-person course meets. They can participate in classroom lectures by seeing and hearing the instructor, in addition to asking questions and participating in classroom discussion.

(v) Faculty members in appropriate disciplines in collaboration with other institutional personnel shall participate in the design of courses offered through a distance education program.

STI faculty members design all distance learning programs.

(b) Role and mission

(i) A distance education program shall be consistent with the institution's mission.

The distance education program at STI is identical in content and impact to the live training program and has been designed, with strong faculty leadership and deep embedded course and program assessment, to focus precisely on meeting STI's mission to develop leaders to strengthen enterprise and global information security.

(ii) Review and approval processes shall ensure the appropriateness of the technology being used to meet a program's objectives.

The appropriateness of the technology STI uses for distance education has evolved over more than 11 years to be optimized for meeting the active learning needs of full-time working professionals, and it been assessed and approved by STI faculty. But that is not the end of the development process. The distance learning technology is continuously evaluated through evaluations completed by every one of the more than 3,000 cybersecurity professionals using it each day. If a course is not helping students master the key learning objectives, we hear about it quickly and fix the problems.

(c) Faculty support

(i) An institution shall provide for training for faculty who teach with the use of technology in a distance education format, including training in the learning management system and the pedagogy of distance education.

Faculty who participate in our OnDemand, Live Online , and Simulcast distance learning modalities undergo specific training to help modify their style to this format. We engage a team of individuals to assist in online-specific methods to enable virtual student-faculty interactions, including (when a class is Simulcast to students) employing an assistant in the room who participates in the class on behalf of distance students by flagging the instructor's attention when questions are asked or issues are raised by virtual students.

(ii) Principles of best practice for teaching in a distance education format shall be developed and maintained by the faculty.

Members of the STI faculty have developed guidelines for best practice when teaching in our distance education formats. The guidelines are reproduced below.

Instructor Guidelines for SANS Simulcast Classes

What to Expect

During a SANS Simulcast you will be teaching live students in the same room AND students at remote locations. To accomplish this, your on-site moderator will log into GoToTraining and our system will capture everything that is projected in the classroom. You will also wear a wireless microphone to transmit your voice to remote students. The moderator will also set up a webcam and broadcast video from the classroom. We highly encourage the use of video, but if you do not want video to run in your class, please contact the Simulcast staff.

All-day classes will be broken into two sessions: morning and afternoon. When you break for lunch please remind all students to log out of GoToTraining and to log into the afternoon session when they return. You will also need to do the same thing, so please return from your lunch break a few minutes early. The key to teaching a successful Live Online ! Simulcast is to always **remember that you are teaching remote students; keep them engaged** by promptly responding to their questions and periodically addressing them directly ("Before we move on, are there any questions from our remote students?").

Advance Planning

1. The Live Online ! and OnSite teams will schedule a planning call with the customer point of contacts two weeks before the course; please plan on attending this call.
2. The AV kit that contains all necessary equipment for the Simulcast will be shipped to the Simulcast location prior to class.

3. The Live Online ! support team will be setting up the audio equipment and test the setup with you. This test is critical to the success of the Simulcast session and must be completed prior to starting class.
4. If it is possible, plan to do the audio testing the day before class starts. If this is not possible please make sure you arrive 2 hours early on the first day of class to complete the audio setup.
5. The Live Online ! team will introduce you to the virtual moderator who will be working the classroom. This moderator is a SANS employee who is there to assist with the running of the Elluminate platform, running labs, and assisting with student questions. Many instructors prefer that the moderator relays questions from the virtual students by raising his or her hand and reading the question.

Audio Tips

6. Do not wear your cell phone on your belt next to the transmitter or lay it next to the receiver by the laptop. Your cell phone and student cell phones can create interference. You may need to disable Bluetooth functionality on your phone if it is causing buzzing.
7. Leave your wireless microphone on at all times, but turn off your GoToTraining audio during breaks. To do this, simply ask your on-site moderator to mute you on the Simulcast laptop.
8. ALWAYS repeat comments and questions from students at your location; remote students can hear you, but all other sound will be muffled or inaudible.

Starting Class

9. When it is time to start class, your moderator will start the recording and give you a signal that everything is ready on the remote side.
10. After the moderator has turned the class over to you, introduce yourself and briefly explain to students how the Simulcast class will work.
11. It is important to make the remote and on-site students aware of each other. Identify and welcome each remote site by name. A roster with the remote sites and student counts will be provided to you.
12. Please encourage remote students to participate by typing their questions and comments into the Chat window.
13. Directing questions about class material to the virtual students can also help to keep them engaged throughout the class.
14. The moderator will relay any questions from the online students to you.
15. Discuss any other housekeeping items as needed (timing of breaks, confirming that VMWare is correctly set up, etc.).

Teaching Tips

16. ALWAYS repeat comments and questions from students at your location; remote students can hear you, but all other sound will be muffled or inaudible.
17. If you need to discuss issues that students should not see, please use the “Organizers Only” or “private message” chat option as your means of communication.
18. Address remote students often to ensure they feel like they are part of the class; remote students become passive listeners if they are not actively engaged.
19. All scripts, videos, demos, etc. that you wish to show to students must be shared with GoToTraining’s application sharing feature.
20. Remote students’ systems (and your host’s network) can be slowed down if you send very large files. If a file is necessary for class try to send it before class or during a break. If it is not course-related (e.g., music while on break), consider not sending it.
21. Use the GoToTraining timer when breaking from lecture so remote students know when class will be resuming; tell the moderator how many minutes you would like and they will set up the timer for you.

22. When breaking for lunch, please explain to students that they will need to log out of the morning session and log into the afternoon session upon their return.
23. Allow plenty of time to log into GoToTraining when arriving in the morning or returning from lunch. Depending on the location, you may have to extend the lunch break.
24. Conduct a quick audio check after each break and lunch to confirm that your microphone is on and that your remote students can hear you.

Suggested Best Practices

Jason Fossen:

- Each day I used a second laptop to log onto Live Online as an attendee so that I could see how fast my application sharing window was updating its screen.
  - ◊ It was also useful for checking the sound, video, and file-sharing features.
  - ◊ I granted my other account moderator status so that, in case my primary laptop had an issue, I could switch over to the secondary and continue teaching.
- New Live Online instructors (or new laptops for prior instructors) should go through the setup and test process before flying on-site; there won't be enough time to fix any problems like these the morning of.
- Return early after lunch to log back into GoToTraining
- Make sure your Internet connection is wired and not shared by the students.
- Make sure to have the Live Online emergency contact info on hand.
- The instructor should have the slides to teach the course on his/her laptop in case the slides in the Live Online system are missing, wrong, or have any problems.

Jason Lam:

- Make sure that the OnSite students are aware of the virtual students.
- Be available for remote students before or after class in the Elluminate Office session.
- Depending on the class size and your teaching style you might need longer than usual to prepare for class (questions, demos, labs).
- Have the moderator type names of products, vendors, URLs, etc. in the chat for the virtual students.

(iii) An institution shall provide faculty support services specifically related to teaching through a distance education format.

SANS Simulcasts are supported by the OnSite and Live Online teams. The OnSite team takes the lead with most sales issues, while the Live Online team provides most of the support during class. While you are teaching you will have one or more Live Online moderators in the Live Online virtual classroom to provide assistance with labs and logistics.

(d) An institution shall ensure that appropriate learning resources are available to students including appropriate and adequate library services and resources.

The challenges of information security are constantly evolving, and excellence in performance demands continuous monitoring of changes in threats, technology, and practices. SANS conducts an extensive research program that helps STI students and alumni maintain their edge in security. The SANS Resource Center is a compilation of thousands of original research papers, security policies, and security notes, along with a wealth of unique network security data. The list below outlines some of the primary resources available.

- The SANS Information Security Reading Room contains more than 2,000 original research studies, not available from any other source, in 76 knowledge domains relevant to the study of information security. They are downloaded more than a

million times each year. The Reading Room is available at http://www.sans.org/reading_room/.

- The SANS Security Policy Collection contains model security policies developed by major corporations and government agencies. The collection contains about 35 policies and grows as new security issues arise and policy templates are needed.
- The SANS Top-20 V7 is a consensus list of vulnerabilities that require immediate remediation. It is the result of a process that brought together dozens of leading security experts.
- The SANS Newsletter Collection helps keep students up to date with the high-level perspective of the latest security news.
- The Security Glossary is among the largest glossaries of security terms available on the Internet. It was developed jointly by SANS and the National Security Agency and provides authoritative definitions of many of the specialized terms students will encounter.
- The SANS Collection of Frequently Asked Questions about Intrusion Detection contains 118 authoritative discussions of the primary topics that arise when planning and implementing intrusion detection technologies. The collection is available at http://www.sans.org/security-resources/idfaq/.
- The SANS Internet Storm Center Archives contain contemporaneous analyses of new attacks that are discovered on the Internet. The archives constitute an extraordinary research asset because of the depth of the analysis and the currency of the topics covered. They also provide SANS students with access to raw data, summaries, and query facilities to analyze malicious Internet traffic records. This is a rich data source for advanced security research projects that analyze attack patterns and how fast worms spread through the Internet.
- SANS Web Briefings held several times a month feature SANS faculty and other security experts providing up-to-date web briefings for SANS alumni on new threats seen at the Internet Storm Center, new technologies that are emerging, and analysis of security trends.

(e) Students and student services

(i) A distance education program shall provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.

- Curriculum information is posted, in detail, at the SANS.EDU website at https://www.sans.edu/academics/

- Course and degree requirements are posted online in the STI Course Catalog at https://www.sans.edu/downloads/STI-Course-Catalog-2018.pdf

- The nature of faculty/student interaction are described on our website at https://www.sans.edu/academics/course-delivery/more

- Assumptions about technology competence and skills are posted at our Admissions website at https://www.sans.edu/admissions/masters-programs

- Technical equipment requirements are posted with individual courses at the SANS course website.

- Learning management systems information is posted in detail at https://www.sans.org/ondemand/faq

- The availability of academic support services and financial aid resources is posted at https://www.sans.edu/students/services, and on page 33 of the Student Handbook at page 33, https://www.sans.edu/downloads/sti-student-handbook.pdf

- Costs and payment policies are posted at https://www.sans.edu/admissions/tuition

(ii) Enrolled students shall have reasonable and adequate access to the range of student services to support their distance education activities.

With STI students taking approximately half of their credits through distance learning, the overall satisfaction with student services may be considered a reliable surrogate for effectiveness of distance learning student services. Evidence from student surveys indicates that measures of overall student satisfaction are high (above 90%)/. Quantified measures of specific sub-processes with student management were also high, with about 90% of respondents saying they were "Somewhat Satisfied" and "Very Satisfied" for each of the operational elements (Table A.4.2).

Table A.2.2. Student Satisfaction with Student Management as Reported in the 2016 Student Experience Survey

	Very Dissatisfied	Somewhat Dissatisfied	Somewhat Satisfied	Very Satisfied
Registration/Billing	<1%	10%	21%	68%
Academic Advising	2%	8%	25%	65%
GI Bill Certification	2%	6%	17%	75%

(iii) Accepted students shall have the background, knowledge, and technical skills needed to undertake a distance education program.

Our Cloud Security students will be experienced and working adult professionals in a highly technical field. Thus, they have the needed background, knowledge, and technical skills to use the distance learning modalities.

(iv) Advertising, recruiting, and admissions materials shall clearly and accurately represent the program, and the services available

Advertising, recruiting, and admissions materials for Cloud Security students are currently being drafted. STI has a solid record of meeting Middle States' high standards for transparency and accuracy in all its marketing and admissions materials and will continue to do so.

(f) Commitment to support

(i) Policies for faculty evaluation shall include appropriate consideration of teaching and scholarly activities related to distance education programs.

Every teacher is evaluated every day by every student, and those evaluations specifically measure the teachers' effectiveness in distance education. Those evaluations affect teachers' compensation as well as their long-term career prospects with STI.

(ii) An institution shall demonstrate a commitment to ongoing support, both financial and technical, and to continuation of a program for a period sufficient to enable students to complete a degree or certificate.

STI has adequate faculty, infrastructure, and financial resources, as demonstrated in Sections H, J, and K, to implement the new Cloud Security program. Further, because the undergraduate program is core to our mission, and was specifically discussed during the Middle States 2018 Team Visit as a critical step for meeting that mission, we have demonstrated both the commitment and resources to maintain the program for many years.

(g) Evaluation and assessment

(i) An institution shall evaluate a distance education program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.

STI employs a three-level evaluation program completely embedded in the curriculum. The 2018 Middle States Evaluation Team commended this evaluation methodology: "SANS Technology Institute should be commended for the fact that its curriculum automatically embraces learning outcomes and program outcomes." The assessment system and processes are detailed in Section M. This same system will be used in the distance learning component of the proposed Cloud Security program

(ii) An institution shall demonstrate an evidence-based approach to best online teaching practices.

STI online teaching practices are currently in use by more than 3,000 students, and at least 50,000 students have used it during the past eight years. Each of those students evaluates the effectiveness of the learning modality in every course, and we continually improve the practices to ensure those ratings continue to match or exceed live classroom training scores.

(iii) An institution shall provide for assessment and documentation of student achievement of learning outcomes in a distance education program.

Ultimate student achievement in the Cloud Security program will be measured by grades on the internationally standardized GIAC exams for each area of security. We compare these scores in distance and in-person learning modalities. As shown in Table A.4.3, the GIAC test scores in distance learning are essentially identical to scores of students who used live, in-person residential training programs:

Table A.2.3. Comparison of GIAC Exam Score Performance via Live and OnDemand Modalities, 2014–2017

Modality	Overall Score	Master's Program	Certificate Program
Live Class	84.6	86.6	82.4
OnDemand Class	83.7	87.2	82.0

We will continue to monitor GIAC scores in the Cloud Security program, by delivery modality.

Appendix 3. Summary Listing of Cloud Security post-baccalaureate certificate Faculty

Last Name	First Name	Highest Degree	Highest Degree Field	Academic Rank	Title	Status	Courses Taught
Kim	Frank	Master's	MBA	Faculty Fellow	Program Director (Cloud Security)	Full Time	ISE 6630, ISE 6650
Nicholson	Ryan	Master's	Cybersecurity and Information Assurance	Instructor	Instructor	Part Time	ISE 6610
Ullrich	Johannes	PhD	Physics	Faculty Fellow	Dean of Research	Full Time	ISE 6615
Johnson	Eric	Master's	Information Assurance	Senior Instructor	Professor	Part Time	ISE 6620