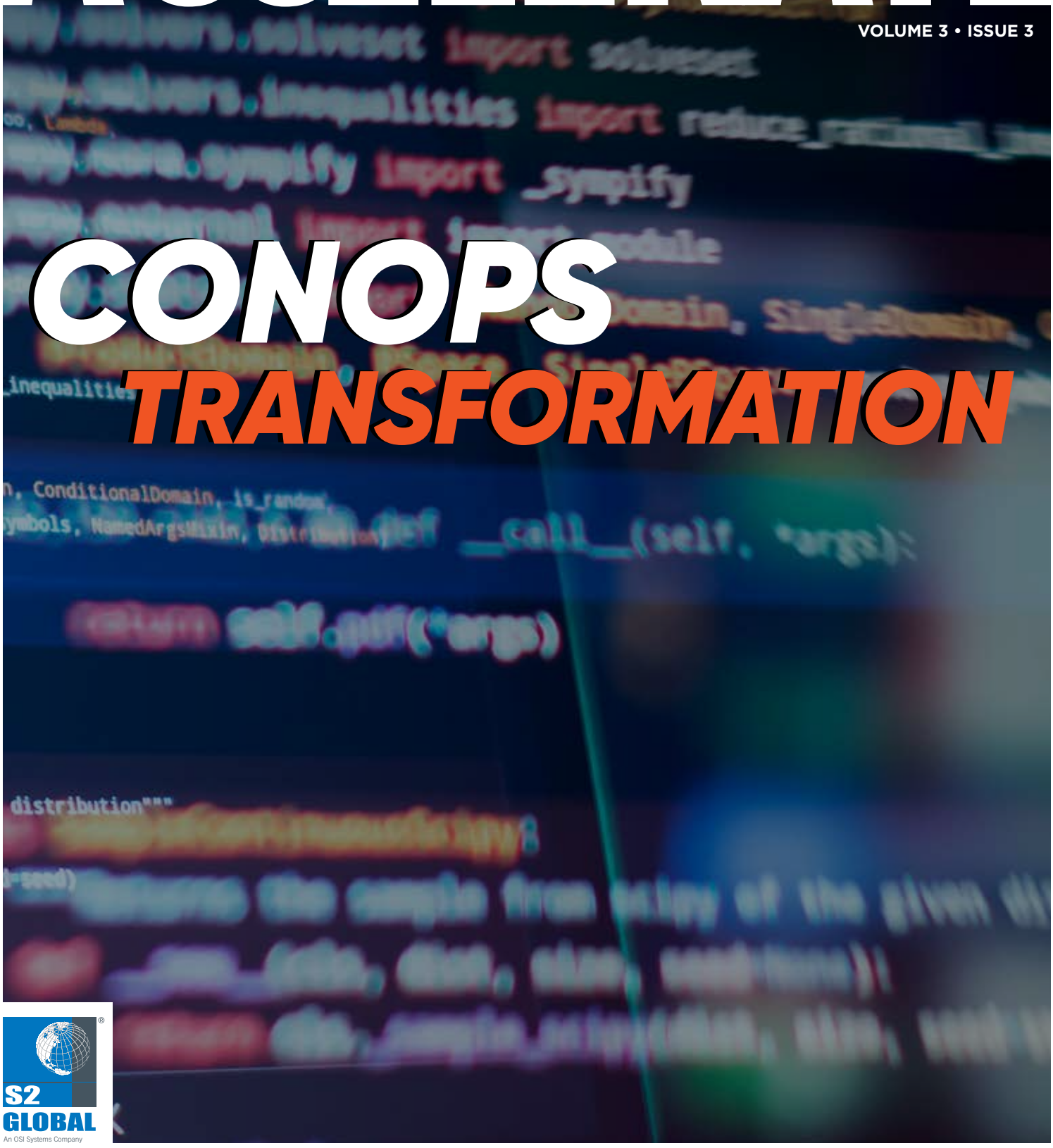
ACCELERATE

VOLUME 3 • ISSUE 3



CONOPS TRANSFORMATION

S2 GLOBAL
An OSI Systems Company

TRANSFORMING INSPECTION CONOPS TO ACCELERATE SECURE TRADE

As we embarked on creating the latest issue of Accelerate, we discovered a common theme among our industry peers: the challenge of navigating the myriad technological advancements available today while keeping an eye on the future. This issue is designed to help you chart a clear path forward, tailored to your organization's unique needs.

In this edition, we delve into the Concept of Operations (CONOPS) a framework that can often seem overwhelming when you're focused on achieving specific outcomes. We aim to demystify this concept by guiding you through a process of reviewing past practices, understanding current technological capabilities, and envisioning future possibilities. This holistic approach is essential for designing an inspection operation that meets everyone's needs.

By the end of this issue, you'll have a comprehensive understanding of how to leverage technology to elevate your operations. Additionally, we introduce you to our cutting-edge solutions: CertScan® for seamless integration of operations, S2 University for inspector training, and Compass for advanced algorithm development and data services. These tools are designed to help you confidently make the leap into the future.

Join us as we explore these innovations and equip you with the knowledge to transform your inspection operations.

S2 Global provides an intelligent platform that delivers accelerated integrated inspection services to secure trade, transport and events.

S2 Global
United States of America
www.screeningsolution.com

FEATURED ARTICLES

ACCELERATE
VOLUME 3 • ISSUE 3

THE CREATIVE DESTRUCTION OF CUSTOMS CONOPS

AUTHOR
Jeffrey Goldfinger
Capture Enterprise Solutions Director
S2 Global
jgoldfinger@screeningsolution.com

As we humans began our transition from small groups of nomadic hunter-gatherers to permanent settlements, a commerce problem arose – borderless isolation. For roughly eight thousand years, we self-segregated into ever larger city-states in just a handful of pockets along the Tropic of Cancer from the Eastern Mediterranean to Far Eastern Asia.

Then something magical happened about 4,000 years ago. The famous "Silk Road" emerged. The Silk Roads forever changed the world economy.

This interconnected travel corridor stretching more than 6,500km opened a vast new world to support more than merely the flow of goods. It facilitated religious, scientific, cultural, linguistic, and philosophical exchanges on a scale never before seen. More recent examples of such impactful inventions include the steam engine (1698) which begat the Industrial Revolution and rail transport, the airplane (1903) which exponentially shortened global travel and trade delivery times, the transistor (1947) which heralded the digital age, the Internet (1969) which enabled eCommerce, and now generative artificial intelligence (GenAI)(2018), whose long-term effects are as yet unknown.

Welcoming Creative Destruction

Each of these examples is what the Austrian economist Joseph Schumpeter called "creative destruction" – the process whereby a new tool or technology completely upends and makes obsolete the old way of doing business. This creative destruction effect can be remarkably swift.

Below are two photos of Manhattan streets in New York City comparing a turn-of-the-century (circa 1900) view showing a sea of horse and buggies against a contrasting photo just fifteen years later showing a sea of cars. Local transportation of both goods and people by horse-drawn conveyance was fully replaced by more rapid, more distant, less "crappy" (literally) means almost overnight such that those organizations and individuals who could not (or would not) adapt were quickly made obsolete. For a more recent example, notice how quickly ride-sharing (e.g., Uber, Lyft) replaced traditional taxi and rental car services around the world.

New York City Transport 1908 and 1915

Nearly all forms of creative destruction produce extraordinary opportunities to accelerate commerce. However, they also contain many challenges regarding safety, exploitation, cultural norms, and sovereign regulations. Therefore, to achieve the dramatic increases in efficiency and effectiveness that new technologies portend requires adoption and / or adaptation of new concepts of operations (CONOPS).

Land and Sea Ancient Silk Road

The original Silk Road technology (the paths) and associated CONOPS developed over years, if not decades. We no longer have that kind of luxury.

Going with the CONOPS Flow

We are just an eye blink past our most recent experience with forced isolation from a global pandemic, with many challenges to keeping cross-border commerce flowing smoothly, safely, and securely – not unlike the challenges our parents, grandparents, and ancient civilizations faced. The pandemic demonstrated that new CONOPS such as work-from-home, food delivery, and mass vaccinations were essential to keep commerce flowing. More importantly, how quickly businesses and individuals could adapt to the new CONOPS created a divide between those that flourished and those that perished.

Here we can learn something else from the Silk Road. It facilitated trade among merchants and conveyors of products largely unfamiliar to the rest of the world by individuals that spoke a variety of languages, also unknown to each other. Yet they managed to somehow standardize their trading interactions.

This is the genesis of S2 Global's CertScan® platform and related services. Its ability to "speak" various OEM digital formats, human languages, and the WCO's new unified file format (UFF) has produced several creative destruction improvements for its early adopters. In other words, we now have a Digital Silk Road integrating, storing, and sharing all forms of customs information (imagery, manifests, biometric, risk) for the benefit of all stakeholders – producers, consumers, and regulators. However, to achieve CertScan's anticipated outcomes required a complete rethinking of customs agency and inspection agent CONOPS and workflows.

For example, customs organizations are accustomed to training and assigning one image analyst at a time to each endpoint scanner. Without a common viewer, each scanner original equipment manufacturer (OEM) developed their own, proprietary user experience (UX). The combination of these two strategies has settled upon a customs community standard ratio of one image analyst to one endpoint (1:1).

Disruptive Tech + Creative CONOPs = Substantial Outcomes

With a networked integration platform like CertScan located at a consolidated command center, properly trained agents are assigned to more efficiently read and interpret images from multiple scanners in sequence, using a single user-friendly UX irrespective of the OEM resulting in a more efficient ratio of one-to-many (1:M). With the optimum number of workstations and analysts, this new CONOPS increased scanning rates from an average 10% or less to a remarkable 100% in just a few short weeks.

Intuitively, there's an assumption that such a 10x improvement in scan rates would drastically reduce officers' ability to screen for illicit cargo or to properly collect import / export duties. However, new CONOPS and workflows at the port of entry and within the command center related to risk analysis, secondary screening, and data sharing proved otherwise.

Furthermore, increasing scan rates while simultaneously maintaining or enhancing security and regulatory compliance normally implies the necessity of growing the workforce or dramatically slowing the flow of conveyances through the inspection lanes. Yet once again, with the proper combination of technology and modified CONOPS, today's workforce was able to achieve tomorrow's objectives.

To make the original Silk Road truly effective, the early adopters had to educate and train the late arrivals. Before the advent of universities (1088) and vocational schools (1876), apprenticeships were the most common form of preparing the adopters and adapters for their new jobs. Even education has seen its version of creative destruction and changing CONOPS in various forms to include self-paced learning, online degrees (1989), professional licensing, massive open online courses (MOOC) (2008), gamification, and micro-certifications.

Some technologies are not merely step changes, but instead are complete transformations.

Tony Seba, the world-renowned author, speaker, researcher, and thought leader on disruptive technologies has pointed out that the automobile was not just a faster horse. Rather its introduction was transformative into something entirely new for both personal and business transport. He routinely reminds his audiences that "a butterfly is not just a faster caterpillar."

Bringing the Future Forward

Discovering the specifics of who, what, and how to blend new technology with innovative CONOPS is important for accelerating the safe, secure, and compliant flow of commerce. This foundation is key to creatively re-shaping Customs inspection. Understanding how software can take the lead role, which tradeoffs you'll make and communicating in the standard language of the border inspection process fosters a creative construction that can only triumph. A

Page 3: Photo 1; https://untappedcities.com/
Page 3: Photo 2; https://www.loc.gov/
Page 3: Photo 3; https://www.worldhistory.org/

CertScan® Inspection Integration Platform

Enterprise software to control your security operation, capture data, employ algorithms, empower your workforce, reduce friction, and increase revenue.

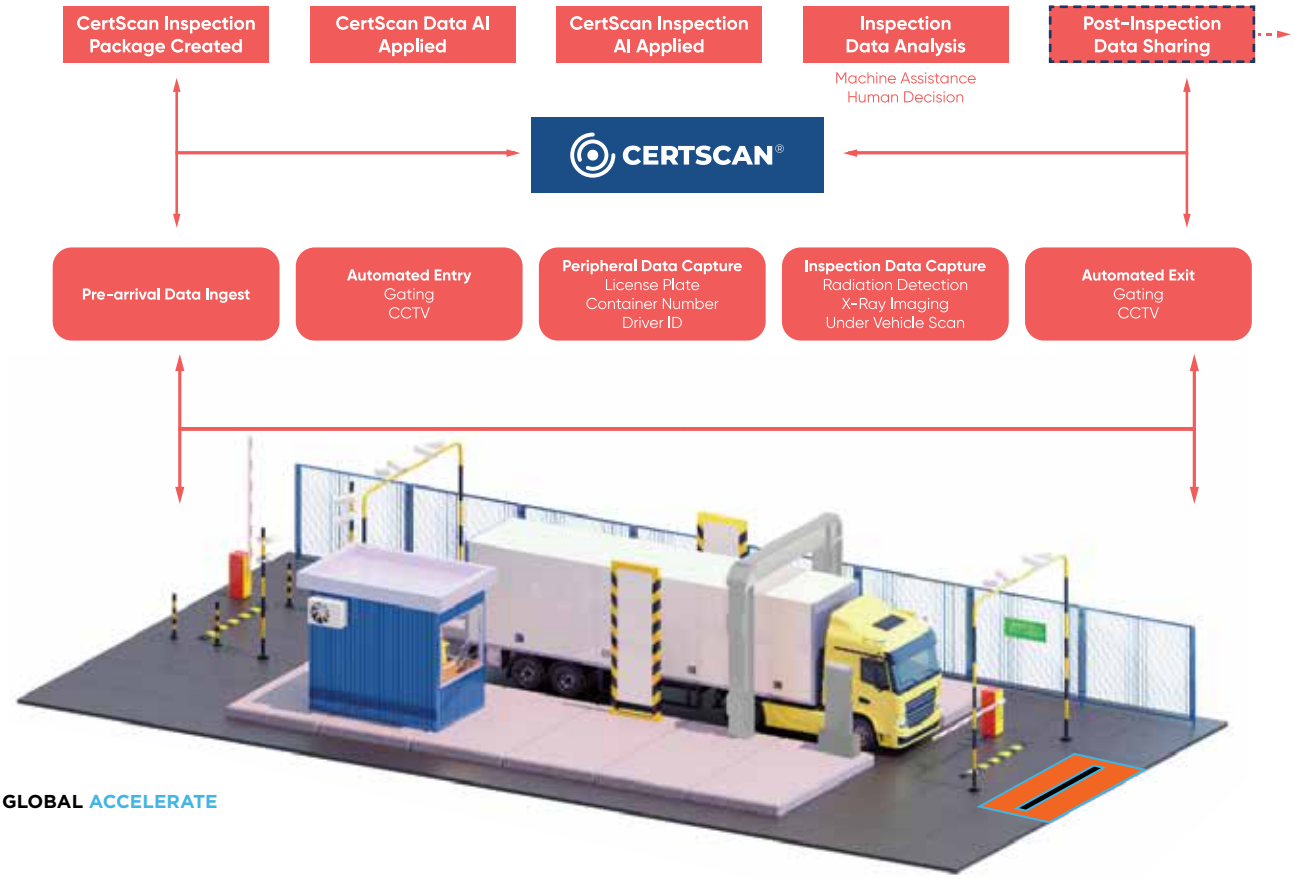
CertScan & Customs

CertScan, by S2 Global, is field proven to substantially increase Customs inspection rates (from 5% to 100%), throughput (by 4.5x), security (by 2.8x), and revenue (by 2x) through our hardware agnostic integration platform. With existing service experience at sixty major border crossings worldwide, we continue to improve the functionality, agent experience, and metrics. Its secure cloud architecture and software-defined workflows integrate trade data, adjacent inspection sensors, and imagery from disparate sources into a common viewer for both onsite and remote validation. Combined with professionalized training from our colleagues at S2 University, your inspection workforce is appropriately scaled for smooth and secure trade.

CertScan delivers a complete, integration solution for Customs inspectors and security professionals seeking to perform at the highest levels.

The results:

- Accelerated Inspection
- Higher Throughput
- Increased Seizures
- Improved Compliance
- More Revenue Collection



OPTIMIZING CUSTOMS INSPECTIONS

CONOPS IN THE DIGITAL AGE

AUTHOR
Paul Hollingshead
Vice President, International Strategic Partnerships
S2 Global
phollingshead@screeningsolution.com

As customs authorities grapple with the range of systems available to assist the inspection of cargo, vehicles and personnel crossing their international borders, they find themselves interacting with multiple user interfaces, platforms and databases. Data on freight or vehicles of interest is often moved across the inspection eco-system by outdated, asynchronous means of human-to-human deconfliction and digital or analogue solutions such as email, chat and telephone. The most striking element is that - even in 2024 - this is mostly done with incompatible, non-networked systems, meaning that the process is manually-intensive and can lead to an incomplete or inconsistent data file due to duplication, ambiguity or error. Without the application of new technology, the totality of border security and inspection processes cannot be managed and orchestrated at the speed and scale required to keep pace with global trade and increasingly sophisticated smuggling methods.

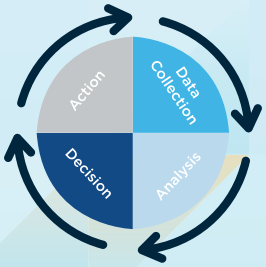
But how did we get here? For the past twenty years, most customs authorities have introduced technologies to accelerate and improve the effectiveness of the inspection of trade and passengers. Scanners, radiation monitors, cameras, e-manifests and risk management systems are now ubiquitous. But in many cases, original equipment manufacturers or suppliers didn't consider a system-of-systems approach, at least not outside their own ecosystems and self-developed closed-architectures. Until the WCO stepped in recently to drive the Unified File Format to assist the export of data, scanner OEMs for the most part locked their systems down all the way to the User Interface, being incentivized to 'lock-in' their buyers to their proprietary eco-system.

The rise of software: smart automations, integrated workflows and connected data

As trade volumes increase, there is an increasing demand for automations and efficiencies in time-sensitive inspection processes. All authorities wish to reduce the cognitive burden on their people and liberate them of time-consuming and mundane tasks. The integration of multiple systems using meshed, real-time communications is desirable to enable the collection, processing, movement and analysis of data, enable decisions, carry out actions and produce audit-able records.

Increasingly customs authorities are focusing on 'systems integration', but can be uncertain where to start and unclear on the desired outcome. To support thinking, we would recommend that integration should not mean all data from every sensor available to everyone, anywhere; the objective is not a connect-athon, data 'lake' or rabbit-from-a-hat trick to suddenly transform operations. Rather, authorities might focus on how to accelerate the process of taking data to information, information to decision and decision to action in a manner which is consistently effective and efficient in achieving greater operational productivity.

Taking this principle, authorities might look to maximize the use of software to replace the dull, dirty or dangerous activities and focus



their personnel on higher cognitive tasks, using operational and ethical judgments where they are most needed. The result would be to extend the agency of human capital in customs organizations and focus it on higher-level, more intellectually noble tasks; making decisions and subsequent actions across a broader area, faster than ever before.

Thankfully, recent advances in software, the commoditisation of compute power and advanced networking solutions enable us to do this relatively easily. We can now meaningfully move away from many humans being required to make a single system operationally relevant. We can create a network of systems to streamline workflows and invert the people : machine ratio. Importantly, this doesn't mean removing people. Rather, it redeploys them, keeping customs personnel at the heart of the operation and doing what they do best. Some of the most efficient screening operations now segregate the capturing of data and its near-real time centralised review by a concentrated team of skilled analysts, supported by machine tools.

Always start with the CONOP

Technology alone cannot solve inspection challenges. A successful operation will always involve a combination of people, technology and process. Optimising how both software and hardware technologies are best applied by personnel is always determined by the process - the concept of operations - which involves an in-depth understanding of the environment, inspection mission objectives, traffic patterns, smuggling techniques, stakeholders in the process, and various constraints and freedoms. A well-defined CONOP optimizes for likely patterns or 'business as usual' while enabling contingency responses to anticipated or unusual changes.

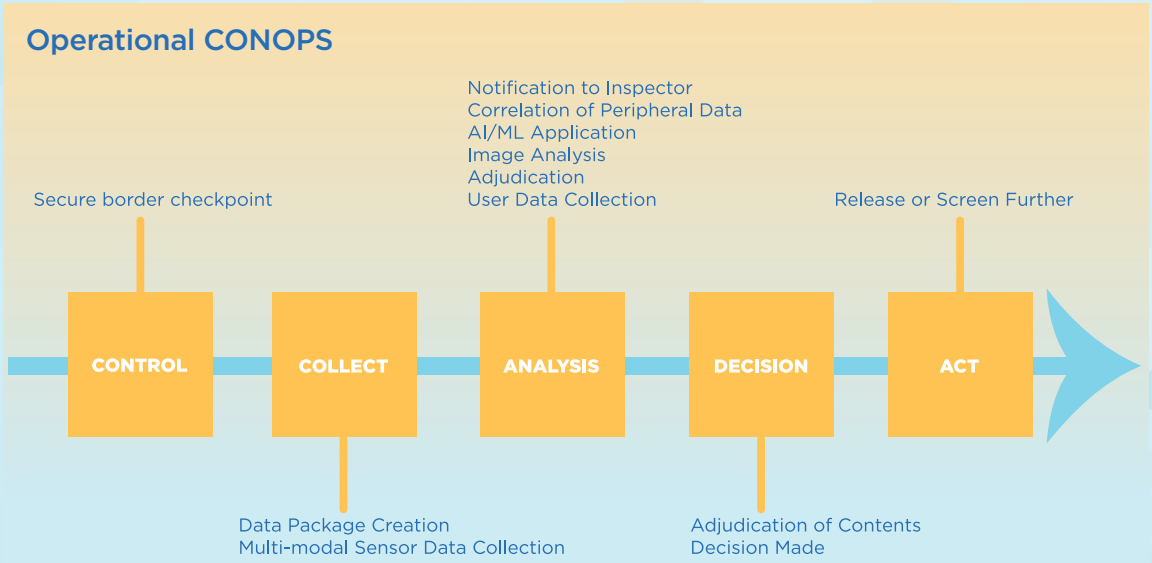
From a data integration perspective, 'starting with the CONOP' is best achieved by defining an end-to-end workflow and considering how data is captured and moved throughout that workflow. This makes it possible to identify how software presents opportunities for acceleration, gathering insights or doing things differently in their entirety. It requires exploring the inspection problem from end-to-end and establishing a desired and measurable outcome. In the case of customs inspection of freight, it can often be broken down into a workflow such as in the below operational CONOPS diagram.

As each of these process blocks can be further subdivided, it is often useful to think of them as a chain made up of many links, secured both physically and in the cyber domain. In general, we wish to avoid humans acting as links in the chain as it introduces delays, inconsistencies, ambiguities, mistakes and the potential for deliberate error. Furthermore, as with any chain, where a link can be broken, the whole thing falls apart. Authorities must secure the process against such vulnerability.

Software-defined, hardware-enabled inspection.

Exploring a software-defined approach may present new opportunities for how a traditional workflow might take place and, indeed, which hardware may be best. Hardware optimized only for people might inhibit wider efficiencies. Consider a software-first workflow which is common to many. Only a decade ago many of us had monolithic alarm systems in our houses - a subsystem and interface locked down by the manufacturers with some potential for remote monitoring. Such alarm systems didn't export information to other systems in the household and likely warranted annual visits from qualified engineers to service them. We used simplistic doorbells to produce an audible alert to anyone in earshot when a visitor pressed it.

Fast forward to today and few people choose something so inconvenient. Modular, open architecture systems have enabled cost-effective, API-oriented smart doorbells and cameras which interact with smart-speakers and mobile devices to alert the homeowner and enable interaction with whomever is on the doorstep. The systems come with an abundance of useful



features from the outset and during any period of subscription, users enjoy continuous updates and developments. By thinking software-first, leveraging cloud compute, affordable networking and commoditized sensors, we have been able to revolutionize the workflow of answering a door or receiving a package. Alternative hardware to the traditional has enabled this.

The same can be said of Non-Intrusive Inspection systems - those which are most open to broader integration may in fact be more valuable. From a hardware perspective, physics impedes significant leaps in capability from one generation to another; additional penetration or wire resolution do indeed deliver marginal gains for the individual inspector, but more value is now derived at enterprise level from the ability to accelerate an inspection, screen more conveyances, provide multi-modal data for easier adjudication or apply large compute power and algorithmic assessment to large amounts of curated data. It is through software that we will see the generational leaps in screening capability

How S2 Global approaches CONOP definition

For over a decade, S2 Global has provided screening capabilities as a service to customs administrations, enabling authorities to focus on their core roles in the knowledge that the deployment, operation and maintenance of screening equipment has been carried out by qualified professionals with an ethos of continuous improvement and development. Much as individual customs authorities whose systems 'in-house' have found, S2 Global recognized the challenge of disparate systems failing to talk to each other and its impact on operational efficiency. As a result, there was a clear need to develop a tool to meet the challenge of integrating and managing multiple heterogeneous sensing systems, networks and databases. Such a tool would enable the optimization of screening passengers, vehicles and cargo, analyzing information and carrying out subsequent actions but also provide audit-able information on solution efficiency, personnel capacity and opportunities for efficiencies or improvement.

Using self-funded R&D, S2 Global developed a modular, open systems architecture software product that can be customized for specific screening solutions using a set of operational business rules which are defined for each site or systems needs. Designed to suit the requirements of small, low throughput, sites as well as large, enterprise- or nation-wide, mission critical screening needs with high uptime and reliability requirements, CertScan is now a fully productized and supported data integration and inspection workflow orchestration platform which is operationally proven and deployed-at-scale in over 18 countries.

S2 Global provides screening capabilities as a service to customs, enabling them to focus on their core roles.

Having such a code base enables CONOPs which are otherwise unachievable; the consideration of sensing modalities, hardware systems, hardware placement, data-flow, system interaction, reporting, monitoring and human involvement is immediately improved by expanded optionality, automation and auditability. Such a solution accelerates processes, reduces cognitive burden, creates staffing efficiencies, reduces costs, and improves auditability. It enables faster, more secure and more efficient outcomes.

Without such software-enablement, screening operators require people as the critical link between systems, increasing staffing, risk and inefficiencies. When it comes to the movement or security of data, people are a weak link in any inspection chain. Though screening remains, for the time being at least, a human-in-the-loop process, human involvement should focus where it is uniquely suited; contextualizing information and making operational decisions.

Furthermore, as the popular debate around AI continues to gather pace, it seems that at this stage, the necessary steps towards a baseline software foundation have not been taken by enough authorities. Without a data integration platform which provides the necessary descriptive analytics and data curation foundation on which advanced predictive and prescriptive analytics must be built, the development, deployment and application of AI/ML will unfortunately remain an unrealizable fantasy for many. For a Concept of Operations worthy of the information age, thinking software-defined, and hardware-enabled is the critical first step. A

ENHANCING SECURITY AND CUSTOMS OPERATIONS: A COMPREHENSIVE APPROACH

AUTHOR
Christian Calle
Senior Content Developer
S2 Global
ccalle@screeningsolution.com

Imagine a bustling land border port of entry, where a steady stream of cargo trucks line up, each carrying goods that need to be swiftly and accurately inspected. In this ever-evolving landscape of security and customs operations, the need for advanced detection capabilities is paramount. This article delves into the development of a robust Command Center Concept of Operations (CONOPS), aimed at equipping participants with the essential knowledge and skills to establish a centralized hub for the remote management of X-ray scanners and other inspection devices. By centralizing these operations, customs officers can efficiently manage the flow of goods, ensuring safety and compliance without causing delays. Let's dive into the key components of this framework.

Centralized Command Center: The Nerve Hub

A pivotal aspect of this initiative is the creation of a centralized command center. This hub will function as the nerve center for remote management, facilitating efficient and effective oversight of various inspection devices. By centralizing operations, organizations can streamline processes, enhance coordination, and improve response times.

The integration of a robust data management software platform is crucial in this setup. Such a platform allows for the seamless collection, storage, and analysis of vast amounts of data, including manifests, container numbers, license plate numbers, and driver information. This centralized data management ensures that all relevant information is readily accessible, enabling customs officers to make informed decisions quickly and accurately.

Training: The Cornerstone of Success

Training forms the cornerstone of this initiative. Participants will be introduced to best practices for image analyst training, ensuring Customs officers are equipped to make swift and accurate decisions. However, image analysts are not just image analysts; they are essentially data analysts who must understand all the data presented at the command center. This includes manifests, container numbers, license plate numbers, driver information, and more. Effective training programs are crucial for developing the expertise needed to interpret X-ray images accurately and integrate this information with other data sources to identify potential threats. As Zig Ziglar famously said, "The only thing worse than training employees and losing them is not training them and keeping them". The initiative will encompass various training methodologies, including hands-on exercises, simulations, and continuous learning opportunities.

Key Elements of a CONOPS for Image Analysis

A significant focus will be on providing training on the key elements of a CONOPS related to image analysis. This includes understanding the workflow, establishing standard operating procedures, and ensuring quality assurance. Participants will learn how to integrate these elements into their daily operations to enhance the accuracy and efficiency of threat detection. This training also supports another key aspect to a successful command center, algorithm data collection.

The Symbiotic Relationship Between Human Training and AI Development

Training is not only vital for human analysts but also crucial for developing effective AI algorithms. Well-trained analysts generate high-quality data, essential for training AI systems. Accurate and consistent data labeling by skilled analysts ensures AI algorithms learn to identify

threats correctly. This symbiotic relationship between human training and AI development enhances the overall effectiveness of detection systems. As Fei-Fei Li, a pioneer in AI, puts it, “If we want our machines to think, we need to teach them to see”.

Continuous training and feedback loops further refine AI algorithms. As analysts encounter new types of threats and update their knowledge, this information can be fed back into AI systems, allowing them to adapt and improve over time. This iterative process ensures that both human and AI components of the command center remain at the forefront of threat detection capabilities.

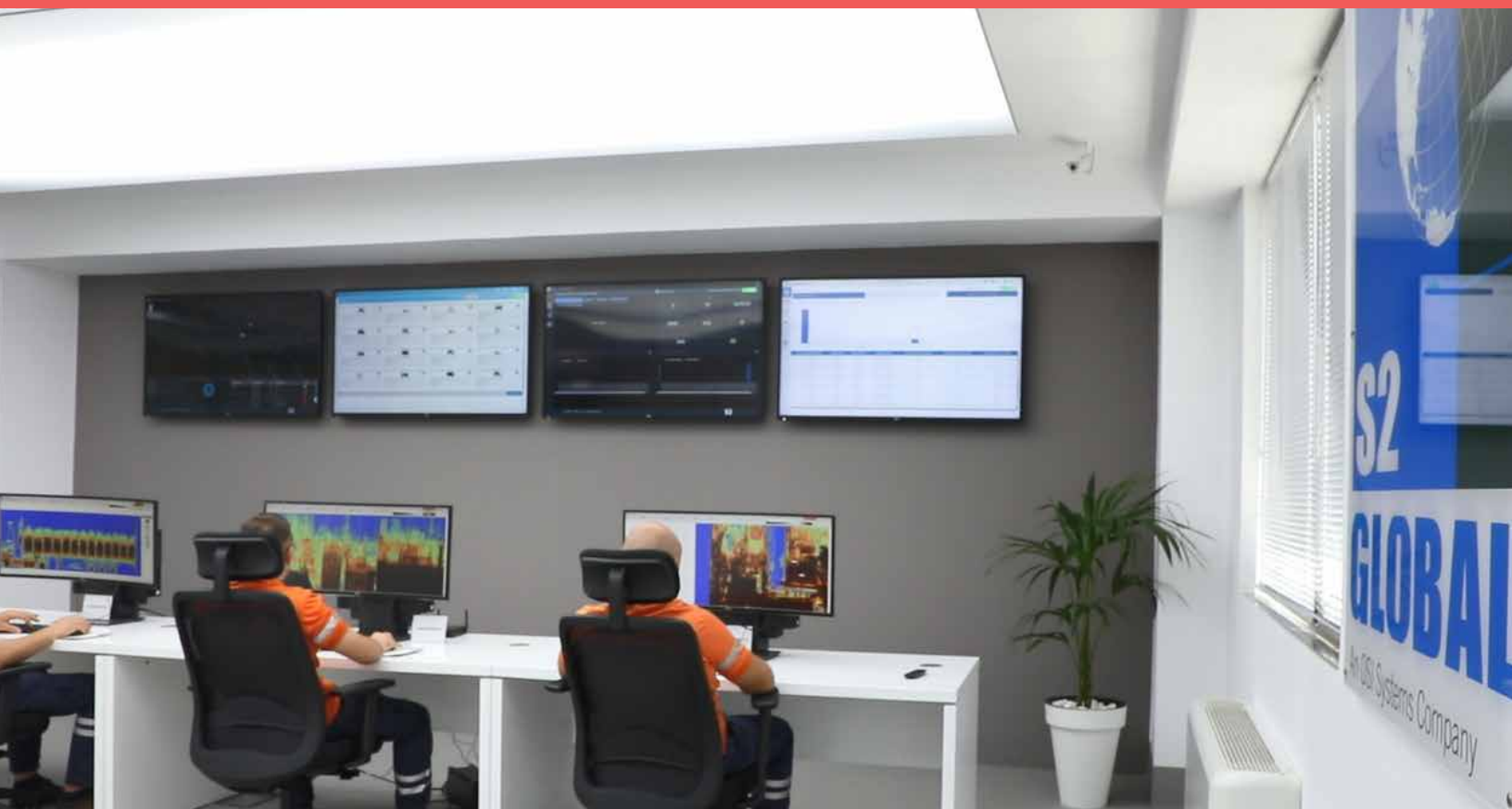
Training Delivery

Interactive exercises will play a crucial role, engaging participants in practical activities to reinforce their learning. These exercises will focus on identifying potential threats in X-ray images, providing real-world scenarios for participants to apply their skills. By actively involving participants, the initiative aims to enhance their analytical abilities and decision-making skills. These interactive exercises will be incorporated into traditional learning management systems and will include new emerging technologies like AR/VR experiences.

Enhancing the Operation

In a nutshell, creating a top-notch command center for remote management of inspection devices is all about centralizing operations, providing stellar training, mastering the key elements of a CONOPS for image analysis, and making learning interactive and engaging. By giving customs officers the right tools and knowledge, we can boost their ability to spot and respond to potential threats. This not only ramps up security but also keeps things running smoothly and efficiently at our borders. By focusing on these key areas, we can ensure our command centers are well-prepared to handle the complexities of modern security challenges, ultimately enhancing both safety and operational efficiency. A

BOOST OFFICERS RESPONSE, TO SECURITY THREATS



URUGUAY SECURE TRADE

INSPECTION OPERATION TO INCREASE SECURE TRADE AT THE PORT OF MONTEVIDEO

In order to increase secure trade at the Port of Montevideo, the Direccion Nacional de Aduanas (DNA) Uruguay contracted S2 Global to provide a full-service inspection operation. To inspect both imports and exports at the port, S2 planned the sites and coordinated the civil works and installation of three high energy x-ray systems, ANPR, OCR and CCTV. The systems will be maintained by our local team. All adjudications will be remote through CertScan integration platform where the S2 University trained team has access to the latest data and detection algorithms for adjudicating quickly and thoroughly. At the inauguration in October of 2024 the National Director of Uruguay Customs, Jaime Borgiani stated, "We work hard, backed by the president, and today we are pleased to have this new technology in the country, which will provide improvements in foreign trade and in the fight against drug trafficking, which is, ultimately, what we aspire to, to keep citizens safer "[1]. A

1. https://www.gub.uy/presidencia/comunicacion/noticias/aduanas-dispone-nuevos-escaneres-ultima-generacion-permanente-funcionamiento

"I think it's great that organizations at the international level are working together for the same thing. Commitment, dedication, loyalty, and honor to combat drug trafficking, smuggling, and illicit activities that harm our populations and economy. Thank you!"

S2 Global Team Member, Uruguay


SCANIA

AUTHORS
Jeffrey Goldfinger
Capture Enterprise Solutions Director
S2 Global
jgoldfinger@screeningsolution.com

Denis Dujmic
Principal Data Scientist
S2 Global
ddujmic@screeningsolution.com

CUSTOMS AUTONOMY

Leveling the Playing Field

Customs agencies and commercial suppliers worldwide are discussing the role of artificial intelligence (AI) in terms of assisting and/or replacing human labor. However, what is often missing or misunderstood in these conversations is the recognition that the decision to use AI is not a binary, yes-or-no choice. Rather, the most important consideration is how much autonomy should the AI be permitted to have.

The purpose of this article is to follow what other industries have done by proposing a draft set of customs industry specific definitions for levels of autonomy.

Keep Autonomous Calm ...

You are most likely familiar with media coverage regarding the development and deployment of autonomous vehicles. Around the world today, there are already fully autonomous wheeled robots roaming warehouse aisles moving supplies from one area to another, cleaning floors in homes and offices, and even delivering food from the kitchen to the table in restaurants.

In each of these examples, the servos, sensors, and on board logic are sufficiently complex, fully integrated, and rigorously tested to allow us to trust these devices to supplement or even replace human labor. These devices autonomously navigate their routes while adjusting to both fixed and moving objects in their path in real-time. It is perfectly understandable then, as a gut reaction, to perceive them as threats to future employment prospects, especially since one of us authors used to be both a janitor and a waiter in his younger life.

However, upon further reflection, we should instead applaud these applications for their utility in performing tasks that are too dull, dirty, or dangerous to be desirable. This frees us humans to be employed in more noble, intellectually satisfying pursuits such as product design, service improvement, and customer care.

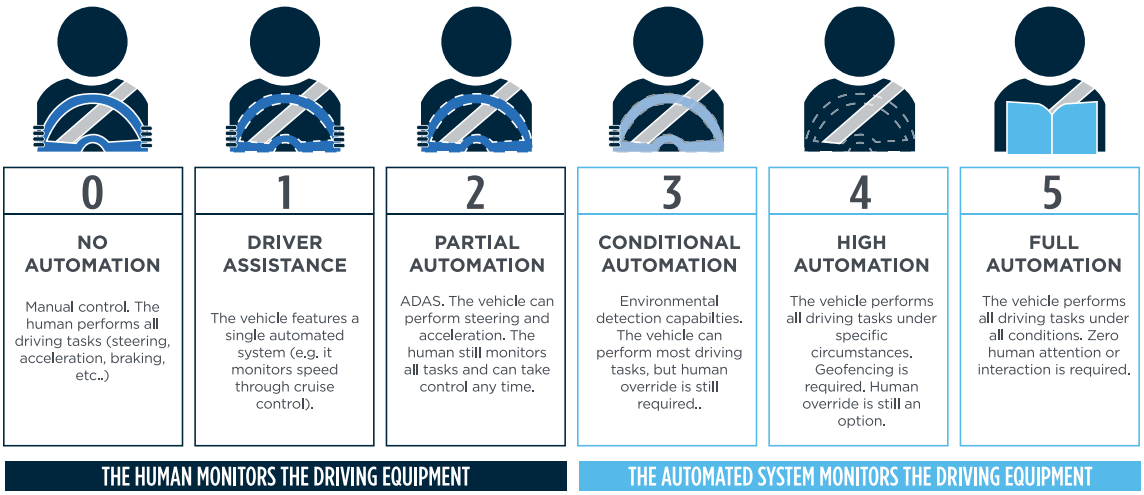
We can unarguably call these robots fully autonomous in the sense that they require zero human interaction, other than perhaps plugging in a power source at the end of the day to recharge – although that too is becoming autonomous.

You might be surprised to learn that Unimation, the world's first robotics company, sold its first factory robot to General Motors in 1963, more than sixty years ago . By the early 2000s, iRobot was selling the Roomba vacuum cleaner for home use, which, along with similar products from competitors have since become nearly ubiquitous in residential settings.

More recently, global attention has been drawn to efforts by Tesla, Waymo, Cruise, BYD, and others to automate passenger cars and light trucks on public roads in an effort to create what some have termed "robotaxis." As a result of these efforts, SAE International, the standards development organization for the automotive industry, in 2014 released J3016 Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles. Quite the mouthful title for sure but also a seminal document that allows all stakeholders – manufacturers, regulators, and consumers – to have a common frame of reference when designing, developing, procuring, and deploying such vehicles.

THE SAE STANDARD DESCRIBES SIX "LEVELS" NUMBERED FROM 0 – 5

LEVELS OF DRIVING AUTOMATION



Source: https://www.3cems.com/the-6-levels-of-vehicle-autonomy_n69)

... and Mind the Autonomous Gap

As a starting point then, we at S2 propose a similar, six-stage continuum as follows:

Level 0 – No Automation

Description: All scanning screening systems and related screening data are manually processed by a human agent who is 100% in the decision loop.

Operational Example: Agent views an x-ray image on screen without any system generated markings, reads a paper or digital copy of the manifest, and manually inspects the cargo.

Level 1 – Data Interpretation Assistance

Description: Data from one or more scanner subsystems automatically analyzes without cross correlation. The human agent makes the adjudication with AI assistance in interpretation of individual data sources.

Operational Example: Automated optical character recognition reads a vehicle license plate at a border crossing and compares it against a database of pre-registered vehicles. The agent provides confirmation of the match for 100% of the vehicles.

Level 2 – Adjudication Assistance

Description: Data from one or more scanner subsystems automatically analyzed with cross correlation. The human agent makes the adjudication with AI assistance in adjudication decision.

Operational Example: X-ray system algorithm detects no anomalous signals compared to digital manifest description. License plate reader matches to known registered operator. Automated system provides recommendation to agent for clearance to proceed (or secondary screening). Agent monitors entire workflow process and makes the final decision.

Level 3 – Partial Adjudication Automation

Description: All scanner data automatically analyzed with cross correlation. Same as Level 2 but automated system clears low-risk conveyance without any agent intervention. Agent can override at any time. Medium- and high-risk conveyance requires specific agent intervention (to let pass or to send to secondary).

Operational Example: Trucks with containers declared as empty are screened to verify emptiness, such that AI makes the decision if the manifest, license plate, operator's biometrics, and x-ray image are all properly documented and aligned. One agent can then monitor multiple lanes and rarely intervenes in the adjudication process unless there's an anomaly.

Level 4 – High Adjudication Automation

Description: Full correlation of both scanning and other data to make fully autonomous decisions in specifically restricted conditions. Automated system adjudicates 100% of scans. Agent intervention for anomalous conditions above a certain threshold.

Operational Example: Primary inspection lanes are entirely unmanned. The decision to allow the passing or diversion to secondary screening of a conveyance is made autonomously with only occasional monitoring by an agent during heightened states of alert triggered by specific threat indications.

Level 5 – Full Adjudication Automation

Description: Algorithms fully correlate all data and autonomous systems without any human oversight under all conditions. Agents only monitor performance and trend data over time either locally or remotely.

Operational Example: Establishment of fully automated border crossing manned by mostly maintenance and repair personnel as required. Inspection agents are on-call to assist shippers and operators with compliance issues.

Our proposed taxonomy is summarized in Table 1.

He Said, She Said, We All Said

As you have probably determined by now, neither the technology nor the political will for level 5 is on the near-term horizon. However, as mentioned earlier in this article, setting a common lexicon now for what that and all the other levels might look like helps all customs-related parties better communicate their challenges and proposed solutions. Additionally, the standardized language helps leaders in both the public and private sectors focus on first principles when determining how best to support adoption roadmaps with appropriate financial and intellectual resources. A

Our goal is to open a dialogue for the purpose of driving towards a consensus sponsored by a suitable industry representative body such as the World Customs Organization (WCO).

To participate in this effort or to just provide us with feedback, please contact the authors or come visit us at any of our tradeshow booths.

Automation Path		Inspection assistance			Inspection automation	
Automation level	Level 0 No automation	Level 1 Data interpretation assistance	Level 2 Adjudication assistance	Level 3 Partial automation	Level 4 High automation	Level 5 Full automation
Scan data	All scan data manually inspected	Data from one or more scan subsystems automatically analyzed without cross correlation	Data from one or more scan subsystems automatically analyzed with cross correlation	All scan data automatically analyzed with cross correlation	All scan and intelligence data automatically analyzed with cross correlation	All scan and intelligence data automatically analyzed with cross correlation
Adjudication	100% human decision	100% human decision. AI assists in interpretation of individual data sources	100% human decision. AI assists in adjudication decision.	AI automatically clears low risk cargo.	AI automatically clears all cargo with human oversight	AI automatically clears all cargo with independent AI oversight

Speed your algorithm development 100x

COMPASS Library & Curation Solution

Confidently implement new algorithms into your process.

Maintain datasets with new information.

Access your curated data anytime within a secure environment.

Large libraries of good data are critical for developing algorithms. Gathering and curating good data is the most time-consuming task for AI developers. COMPASS Library & Curation solution completes the work of curating, labeling and organizing data so you can develop algorithms fast.

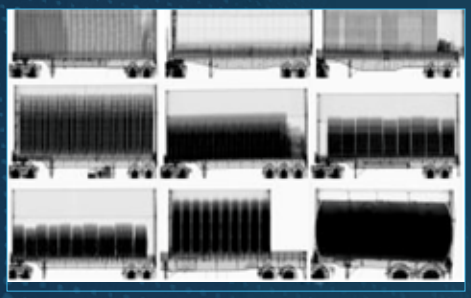
Anyone computing today understands the desire to add helpful automation into their workflow. "_____ should be automatic," is a sentiment felt throughout every organization. We feel this too, and in order to get you there faster, we have developed COMPASS library & curation solution focuses solely on organizing good data so that you can pass it on to qualified algorithm developers for fast implementation into your process.

COMPASS

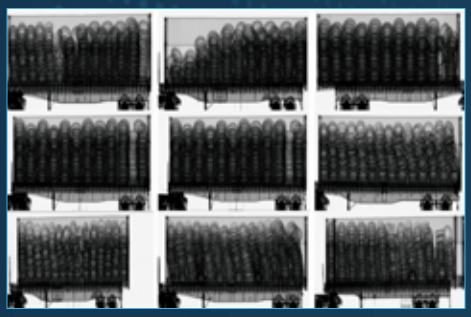
S2 Global's operations experience has helped us build a tool to both algorithmically and manually tune your data fast. Simply provide the raw data to our team and let us get to work. Our team will verify, compare, label, curate and post your data into a quality set that you can use to develop custom algorithms. When we are done, we'll send you access to a secure portal for use by the coding team and they can get to work.

Solution Features

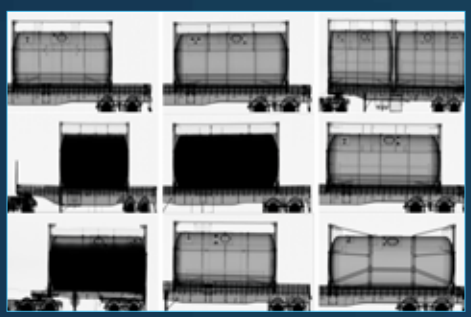
- Curation: An automated and manual curation and labeling of your data to meet standards set by you and the COMPASS team.
- Library: Easy access to a secure, organized data library to build algorithms.



Curated X-Ray Image Library



Selection by Cargo Type (Harmonized Code)



Selection by Container Type (ISO6346)

Discover Degradation Before It Impedes Your AI

COMPASS Intelligent Quality Solutions

Know immediately if degradation is occuring.

Understand where degradation is occuring.

Address degradation issues promptly.

Degradation is impeding your AI.

Running algorithms on bad data can result in less optimal outcomes for every user of the system. Running bad algorithms can increase false positives and cause bottlenecks in the process. The last thing you need is to experience a problem that will only be compounded if not identified immediately.

That's where the COMPASS IQ tools help. Before you run any algorithms, IQ checks for degradation and notifies of any damage.

IQ is available in two formats, IQ-D for raw data before entering the next process and IQ-A for algorithms already running during the process. Each will report any degradation so that you can fix your sources before it gets too bad.

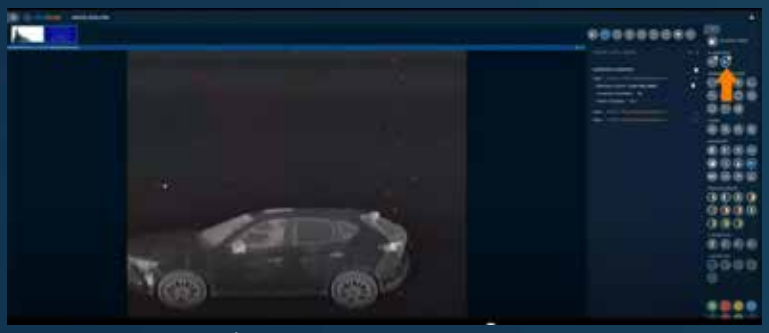


Image Quality Degradation in an X-Ray Scan

Algorithm Quality Degradation in an X-Ray Scan

Solution Options

- IQ-D: Identifies problems with data in your process.
- IQ-A: Identifies problems in your algorithms.

COMPASS

GOTS vs. COTS

An Analysis of Alternatives

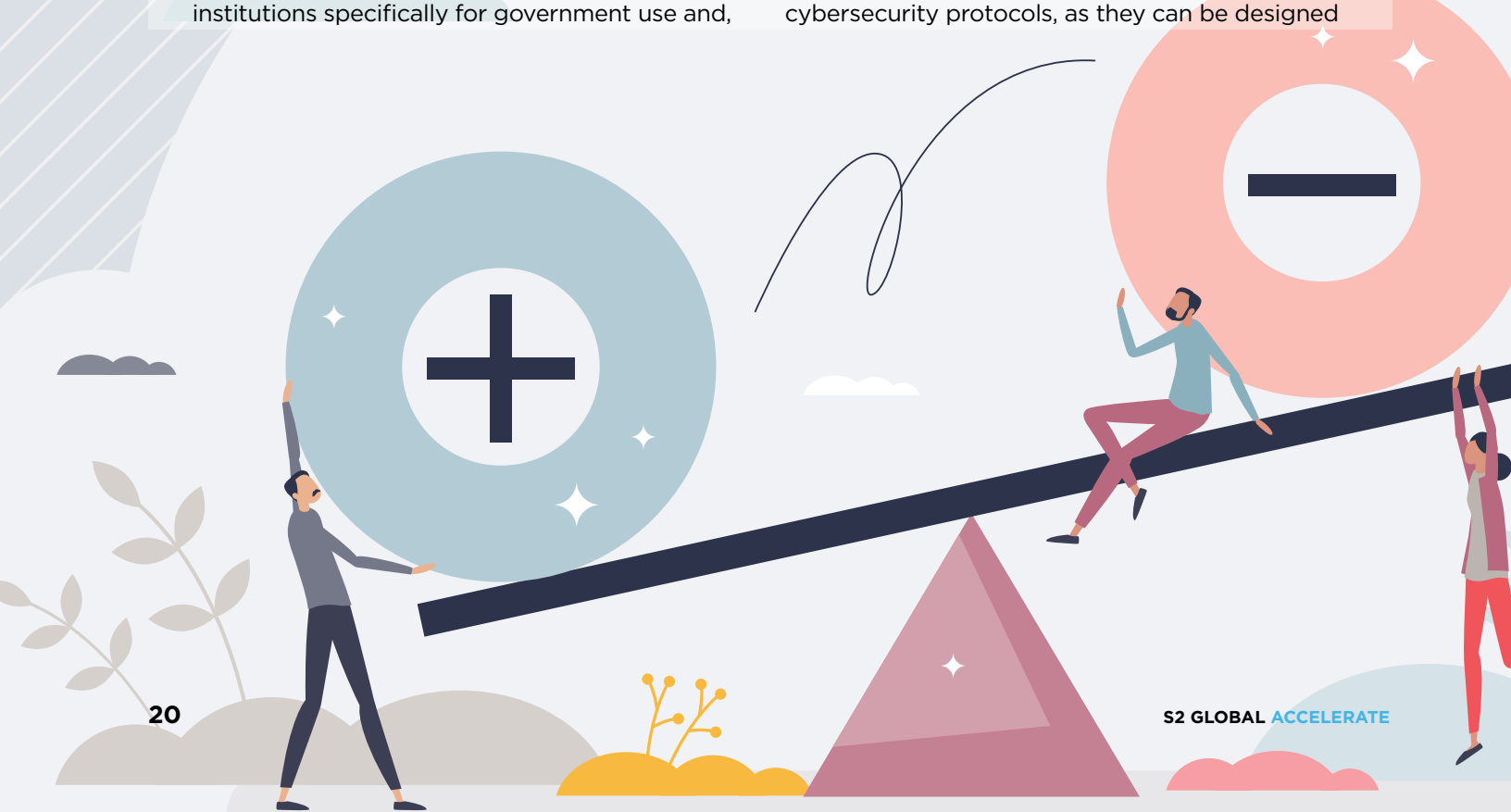
As many organizations struggle with the challenge of implementing technological solutions, they often face the difficult decision of choosing between Government Off-The-Shelf (GOTS) and Commercial Off-The-Shelf (COTS) solutions. The decision to go with one versus the other can be motivated by many factors including available resources, both in terms of funding and people, or internal considerations such as a requirement for a secure platform. Both approaches offer distinct advantages and challenges, and the choice between them can significantly impact the efficiency, cost, and long-term adaptability of the software platform an organization decides to contract.

Understanding GOTS and COTS

GOTS refers to solutions that are developed by government agencies, contractors, or academic institutions specifically for government use and, therefore, funded by the government. These solutions are developed to meet the specific requirements of government operations and are often designed to address specific and unique challenges that commercial products may not adequately cover. On the other hand, COTS solutions are commercially available products that are developed for a broad consumer or private sector market. These products are designed to be versatile and cater to a wide range of individuals, industries, and applications.

GOTS: Why & Why Not

One of the primary advantages of GOTS solutions is their customized nature. Since these solutions are developed to address a specific government need, they are created to meet unique operational requirements. This level of customization ensures that the software aligns closely with the agency's processes and CONOPS. Additionally, GOTS solutions often provide greater control over data security and cybersecurity protocols, as they can be designed



to adhere to a government's IT regulations. Lastly, since the government owns all intellectual property rights to the solution, they are not subjected to monopolistic pricing strategies or vendor "lock in."

Conversely, government organizations are often limited in their ability to acquire sufficient financial and intellectual resources limiting a program manager's ability to deliver the GOTS product on time, on budget, and on performance. Furthermore, the pace of scientific and technical innovation, paired with often stringent security protocols, often causes the public sector to lag behind the private sector in product deployment and adoption. Lastly, as a GOTS solution is deployed, the ability to quickly counter new and evolving threats provides ongoing challenges.

COTS: Why and Why Not

Since COTS products are intended for an open market, development costs are essentially spread across a very wide customer base. Furthermore, the variety of commercial customers and their challenges drives the COTS solution to be far more feature rich while making customized implementations available through value-added resellers (VARs) or through end user-selectable options. Lastly, due to standard marketplace drivers, COTS solutions are usually quicker to deploy and even quicker to be implemented, stress tested by customers and updated. This rapid deployment cycle can be crucial for organizations looking to modernize their systems swiftly or to address an urgent need.

Competitive stressors are yet another driver of COTS innovation. Commercial vendors need to innovate and improve their products to remain competitive, ensuring that customers have access to the latest features and technologies. However, the trade-off for these advantages is a potential lack of customization. COTS products may not fully align with the specific needs of government agencies, leading to compromises in terms of features and functionality.

Most importantly in an increasingly digital world, COTS IT solutions were challenged to address data security, reliability, and availability concerns to the same level of sophistication required by government customers. As cybercriminals migrated their efforts to softer targets in the private sector, COTS products have been forced to adopt increasingly robust cybersecurity standards on par with or sometimes exceeding those of the public sector.

The "Sunk Cost Fallacy"

A well-known theory from the field of behavioral economics called the "Sunk Cost Fallacy", describes how humans continue to finance failing endeavors out of an irrational commitment to prior decision-making and the desire not to be responsible for expended funds going to waste. This can be common in the public sector where organizations are entrusted with being good guardians of public funds. Truthfully, the opposite tactic is most often the better approach to good governance when it comes to the timely termination of GOTS development projects.

The key factor in overcoming the reluctance to cancel a failing or extremely delayed project is to recognize that there are often many useful lessons to be learned and subsequently used to influence the procurement of a more suitable solution. There is a near universally recognized, succinctly stated philosophy describing the COTS development process "Experiment. Fail. Learn. Repeat." In other words, an embracing of failure in early stages in order to achieve more rapid success.

Therefore, government agencies should neither avoid nor demonize GOTS projects that fell short of expectations. Rather, share their lessons learned with those of us in industry to ensure our COTS solutions also address public sector requirements.

To GOTS or Not to GOTS, That is the Question

In conclusion, both GOTS and COTS solutions have their respective merits and drawbacks. The choice to pursue one path over the other should be guided by a thorough assessment of multiple variables followed by the courage to shift in the other direction when the metrics and logic suggest. A

AUTHOR
Shaleen White
Vice President, Business Development
S2 Global
swhite@screeningsolution.com

INCENTIVIZING INNOVATION

Innovation has slowed.

Many customs authorities engage with their supply bases in a manner highly reminiscent of the 20th Century: faced by a limited number of hardware-centric suppliers and provided with constrained commercial toolkits, they equip themselves to carry out the inspection of freight and vehicles mission in a very traditional manner. Consequently, after procurement, they grapple with a panoply of devices to assist the inspection of cargo, vehicles and personnel crossing national borders. Officials find themselves grappling with multiple user interfaces, systems and databases. As the volume and pace of global trade have surged, these officers have found themselves inundated with data. They are caught in an intensive cycle of navigating incompatible systems, burdened with the cognitive strain of correlating, analysing, and making critical decisions.

Contrasted with other sectors which have been completely reshaped by software (automotive, retail, entertainment, healthcare), there is little evidence of such revolution with customs freight inspection: ironically, there is now more AI in an average customs officer's household than in any system they may use to inspect goods crossing their national borders.

Fundamentally, there is a shortage of companies supplying AI and advanced software products to government authorities. Today, the most brilliant data scientists and software engineers in the world are concentrated on ad-optimisation or photo filter apps, drawn by the ease and lucrative nature of working with consumer or commercial markets. The perceived barriers to entry, bureaucracy and limited scalability of government contracts have inadvertently deterred private sector interest in applying advanced software technologies to screening.

This leaves innovation to traditional suppliers, whose business models, organisational structures and incentives may have been human- or hardware-centric. This has not left them positioned to be at the forefront of distributed networks, cybersecurity, the application of AI, sensor fusion or data science. Incremental advancements in their systems have largely been driven by esoteric customer-specifications vs significant independent, internally-funded research and development. This creates slow and poorly-financed developments which may be too niche for other customers. Such an environment isn't ideal for fast-moving software-engineers, who wish to build the best products they can and deploy them widely. They do not wish to atrophy in sectors with slow development cycles or a limited customer base.

What buying behaviours accentuate this?

In any capitalist society, the supply base responds to the signals from potential or actual consumers. Strong demand begets strong supply incentives.

Governments might reflect on how they signal the value of engaging with them to the private sector. Do the following apply?

- Lengthy, opaque or bureaucratic processes - the long cycles of requirements definition, budgeting, where and how to allocate capability does not suit small, innovative companies. This has proven better for scaled companies who can cushion delays and spread risk over their global marketplace leaving governments to deal with mature, potentially monolithic companies vs innovative start-ups.
- Over-specification - too often government departments create a technological straitjacket inhibiting innovation - Requests for Proposal can demand lengthy and esoteric 'needs' such as a specific wire-resolution imaging requirement or energy source vs describing a mission or the outcomes anticipated.
- Emphasis on proposals vs performance; by shifting the weight of assessment and supplier selection into written proposals, government indirectly incentivises companies to put their entrepreneurial effort into bidding processes vs engineering products.
- Hardware-centricity: sequential demand from governments evidence a predominant focus on hardware and incremental improvements in performance over predecessor equipment vs transformative or revolutionary capabilities.
- Focusing on the capital expenditure on products and their subsequent ongoing maintenance vs considering capability-as-a-service or subscription models. Such practices result in rapid obsolescence, sunk cost 'lock-in' to specific products and can lead to perverse maintenance behaviours in the supply chain where service becomes a profitable focus area.
- Desire to own the Intellectual Property - archaic data rights practices or demands on IP ownership can deter new, innovative market entrants who have built valuable capabilities at their own cost.

Introduce non-traditional paths to developing innovation investments.

The software revolution

In 2011, the US venture investor Marc Andreessen argued that software was revolutionising economies by transforming traditional industries and enabling new business models. In that time, companies such as Amazon, Netflix, Spotify, Meta, Tesla have disrupted their respective sectors' competition. The accessibility and reduced costs of internet access, cloud computing, and the commoditisation of sensors have revolutionised the way consumers can live their lives.

But such a revolution hasn't happened for Customs authorities. The processes and tools at border points of entry today are not vastly dissimilar to those of 1991 let alone 2011. Software is yet to revolutionise this sector. Private sector companies must be incentivised to apply talent, funding and business models to doing so. Building world-class software platforms of the quality most consumers now enjoy in their daily lives is an engineering challenge which requires the right foundational business case.

How can governments assist?

- Establish funding for software priorities in border security/ screening: data integration, artificial intelligence, cloud-based storage, cybersecurity. Demonstrate that software-orientated solutions are as valued as large hardware systems such as Customs Control Equipment - signal a clear demand for engineering talent to apply itself to the sector - consider the US CBP's NII-I program (FY24 $12.1m) and AI/ ML algorithm to enhance narcotic detection (FY24 $12.6m), with proposed paths to scale further thereafter. Both have introduced new, innovative non-traditional entrants to focus on a national security challenge.
- Make it easy to do business; think of the delivery of such capabilities as an ongoing service, warranting sustainment, but anticipating increased value in the adopted solution over the lifetime of its contract. Subscription or capability-as-a-service models incentivise responsiveness, continued development, and provide off-ramps for authorities while providing clarity to

incumbents and their competitors on how to perform.

- Focus on performance-based competition vs proposals; put the onus on engineering entrepreneurialism vs bidding capabilities. To encourage companies to invest in any trials, be clear on the prize (i.e. contract value) that such a competition is designed for and award it quickly; there is a value to timely payment.
- Measure outputs and effects, not inputs - any return on taxpayer-funded 'investment' should be reconsidered. Is the output an acceleration of inspection, an improved detection of threats or contraband, reduced strain on staffing or the application of previously unachievable use cases? Focusing on inputs such as wire resolution, x-ray source type, may have a role, but these inputs often create design demands which inhibit innovation.

Measure outputs and effects, not inputs for ROI of innovation programs.

How will the private sector respond?

Much as with the revolutionary products enjoyed by consumers worldwide in their daily lives, governments will have signalled to their supply base on how it should behave and focus its investments. It will incentivise them to:

- Build open, extensible solutions that leverage industry standards (e.g. UFF 3.0, DICOS), software tools, and data sharing, setting the conditions for an integrated System of Systems approach to screening and border security.
- Ensure interoperability of solutions with a variety of third party sensors and systems - ensuring that buyers need not fear 'lock-in' to a specific ecosystem versus the flexibility to choose alternatives or switch to a higher value product or system in the future.
- Conduct self-funded research and development to enhance customer experiences in the knowledge that these will be meritocratically reviewed and might be introduced during the lifetime of the contract.
- Prove meaningful capabilities through operational testing and demonstrations prior to acquisition rather than focusing on 'glossy' slideshows or marketing efforts on paper.
- Offer capability-as-a-service in response to outcome-oriented contracts; companies will be willing to take on the more mundane or specific-skill requirement elements of customs inspection and unburden authorities to focus on their core mission in the knowledge they have an effectively-managed, well-scoped service delivering desired results.

Historically, innovation and technology-development has been driven by the pursuit of profit. Where once government was the premier market targeted by private sector organisations, the rise of advanced networking, accessibility of computing power, commoditisation of sensors and development of software business models has seen a shift of engineering entrepreneurialism towards increasingly accessible business or consumer markets. Government must now compete with those markets to attract the necessary talent and private sector funding to apply itself to its new challenges. By changing traditional behaviours and setting the right incentives, Customs authorities will be presented with more innovative and effective solutions for the 21st Century, ensuring they are equipped to meet the challenges at their nation's borders.

AUTHOR
Paul Hollingshead
Vice President, International Strategic Partnerships
S2 Global
phollingshead@screeningsolution.com

"Best training course I have had in my 19 years of service."

— S2 UNIVERSITY CARGO & VEHICLE IMAGE ANALYSIS STUDENT, CANADA BORDER SERVICES AGENCY

The Critical Element for Effective Screening Operations: HIGHLY TRAINED PERSONNEL

Screening operations are better served when the people who are responsible for the processes are highly trained. S2 University provides security screening training to maximize the skill and performance of your personnel.

S2 UNIVERSITY

www.S2University.com

Sharing *data* ACROSS BORDERS

In an era of expanding global trade, the efficiency of cargo screening processes at a nation's border ports of entry is paramount. The sharing of screening data between Customs authorities is an easily achievable opportunity to improve trade facilitation and security management. By leveraging a network of connected sensors among trusted trading partners, customs authorities can significantly enhance the speed and effectiveness of cargo screening.

The Current State of Cargo Screening

Traditionally, each nation's customs authority has developed its own screening procedures. Often this involves standalone or stove-piped platforms, systems and databases. Where modernisation projects have involved any networking, these are seldom compatible with those of other countries. Such a nation-centric, fragmented approach leads to regional and global inefficiencies, creating as delays and resource burdens, as each country is responsible for capturing (or recapturing) data and analyzing subsequent information independently of the originating nations. Current inspection processes are seldom optimized for speed, let alone the continuous integration of new capabilities, missing out on the digital advancements of the Information Age.

The Case for Data Sharing

At any border port of entry, freight inspection decisions need to be made in a time sensitive manner to prevent congestion. With the growth in global trade, the pressure on authorities to manage screening is seldom supported by a corresponding increase in personnel or technology to achieve

AUTHOR
Paul Hollingshead
Vice President, International Strategic Partnerships
S2 Global
phollingshead@screeni...olution.com

this. Sharing scanning data between customs authorities can streamline this process without warranting significant investment. For example, if Latin American countries export freight to Europe, the exporting authority could share their data and adjudication decisions (radiation readings, x-ray imagery, weight, manifest information and local screening decisions to release), with the importing nation for pre-screening during transit. This would allow more time to review and analyse, while reducing the need for subsequent screening at the port of entry.

Benefits of Data Sharing

Efficiency: Accelerated cargo clearance and reduced port congestion.

Resource Optimization: Lower human resource and cognitive burdens.

Cost Sharing: Nations can leverage each other's screening investments, making the process more affordable.

Enhanced Security: Improved detection of potential threats through collaborative efforts.

Improved Relations: the sharing of data is a trust-based and valuable act of diplomacy

A Software Marketplace: An increased 'surface area' for the deployment of advanced AI/ML algorithms would stimulate private sector efforts to solve the challenges of screening.

Modernization Investments

Often, existing IT architectures are insufficient to meet the potential of exchanging information in a timely and efficient manner. But the advancements in networking, cloud compute and software technologies enable affordable, secure environments for sharing intelligence and sensor data. The resultant improvements in efficiency, auditability and security outweigh any investment in the baseline architecture.

A network to securely and reliably connect sensors and inspection platforms, assisting in the identification of anomalies or items of interest that warrant further investigation.

Shared Understanding

A shared understanding among customs authorities is crucial. By sharing increasing amounts of data over common secure networks, countries can cooperatively select screening platforms, share training techniques and identify further opportunities for collective investments. The WCO has encouraged Non-Intrusive Inspection manufacturers to remove proprietary blocks on exporting data from their systems, which is a necessary first step, but the journey must certainly involve a permissions-based exchange of such data at a supranational level.

The Future of Customs Inspection

As advances in hardware decelerate, the future customs inspection environment will logically involve more sophisticated software techniques, including the introduction of multi-modal sensor fusion, AI/ML techniques to identify anomalies and trends, autonomous systems to carry out repetitive tasks and an ever evolving cybersecurity approach. Machine-to-machine communication will reduce human-in-the-loop processes to link international sensors in a common operating environment, reducing inefficencies and enhancing the effectiveness of cargo screening.

Sharing inspection data port to port accelerates throughput, optimizes resources, and enhances security.

In summary, the value of customs data is measurable - the cost to capture data already involves significant government expenditure. The value of sharing it further afield cannot be overstated. By adopting this practice, international customs authorities can accelerate cargo clearance, optimize resources, share costs, and enhance security. The baseline architectures to achieve this approach to global trade and customs operations are now available and we must actively consider the technological and policy advancements that can support inspection data sharing. A

S2 Global
WORLDWIDE

17+1
Countries Territory

131
CertScan Instances

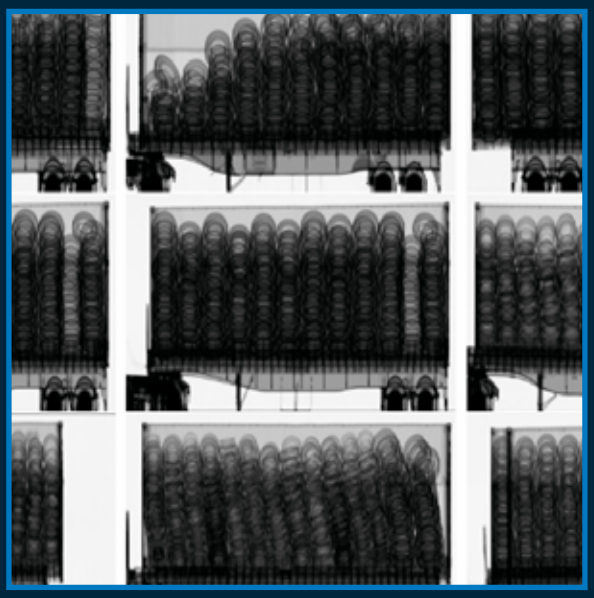
6,315
S2 University Students Trained

7
Build-Own-Operate

+35 Million
Data Packages Processed

S2 GLOBAL
An OSI Systems Company

Operations



COMPASS

Data for AI

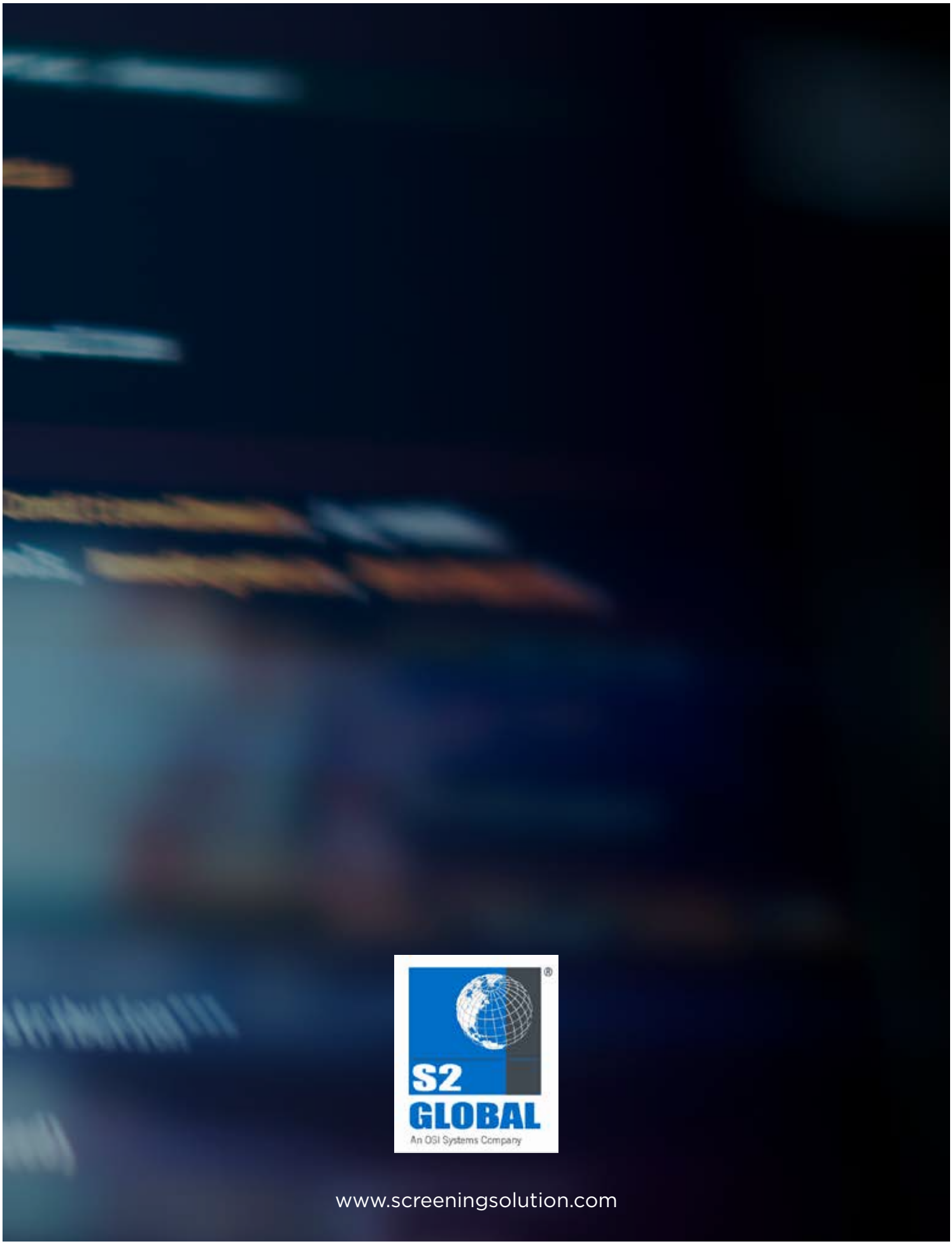
S2 GLOBAL
An OSI Systems Company

S2 UNIVERSITY

Training

CERTSCAN®

Integration



www.screeningsolution.com