

# Rapiscan<sup>®</sup> systems

An OSI Systems Company

## MVXR5000 Hold Baggage Screening (HBS) System Technical Description



### CONTACT INFORMATION

Telephone	
Americas, Canada, Caribbean	+1 310-978-1457
Europe, Africa, Mid East	+ 44 (0) 870 777 4301
Asia	+65 6743 9913
Australia	+61 3 9929 4600
Website	
<a href="http://www.rapiscansystems.com/contactus.html">http://www.rapiscansystems.com/contactus.html</a>	

### Copyright

This document contains Rapiscan Systems Inc. proprietary information that is protected by copyright, and all rights are reserved. No portion of this document may be copied, photocopied, reproduced by any means, or translated into another language without the prior written consent of Rapiscan Systems Inc. Copyright © 2007-2012 by Rapiscan Systems Inc. All Rights Reserved.

### Disclaimer

Rapiscan Systems reserves the right to amend specifications without notice. Product description, images, and specifications are for general references only.

Under US laws and regulations, not all Rapiscan products are available for sale in all countries without restriction. Please contact your Rapiscan Systems sales representative for more information.

### Document Revision History

Rev. #	Date	Author(s)	Description
1	Oct. 2007	BY / HP	Initial Release.
2	Feb. 2008	BY / HP	Modifications for F.B.
3	Sep. 2008	BY / HP	Update for 2010659-6.
4	Feb. 2011	DC / RB / HP	Update with new features, specifications, and descriptions
5	Sep. 2012	BC / DC / BY / HP	Update document for use only with MVXR5000 Part Number MVXR5000-MK4, and software release version 7.1.1 R3.

## Table of Contents

1.0	GENERAL OVERVIEW.....	4
2.0	MVXR5000 SYSTEM PRINCIPLES .....	4
2.1	Multi-Level Screening.....	5
2.2	MVXR5000 HBS System Typical Operation .....	6
2.3	Multi-level Screening Scalability.....	7
2.4	Baggage Handling System (BHS) Integration.....	7
3.0	MVXR5000 X-RAY SCANNER OVERVIEW.....	8
4.0	OPERATOR WORKSTATION OVERVIEW.....	10
5.0	MATRIX NETWORK OVERVIEW.....	12
5.1	Matrix Servers .....	13
6.0	MVXR5000 SYSTEM CONFIGURATIONS .....	14
6.1	Matrix Network Configuration.....	14
7.0	FEATURES / FUNCTIONS.....	15
7.1	Standard Level 1/ Level 2 Screening .....	15
7.2	Image Archiving System.....	16
7.3	Supervisor (Admin) Workstation .....	16
7.4	Level 3 Operator Screening .....	17
8.0	APPENDIX A: MVXR5000 SPECIFICATIONS.....	19
8.1	MVXR5000 System Features.....	19
8.2	MVXR5000 Design and Quality Standards .....	20
8.3	MVXR5000 X-Ray Scanner Specifications .....	22
8.4	MVXR5000 Dimensions and Modular Design.....	24
8.5	MVXR5000 Service Area .....	25
9.0	APPENDIX B: MVXR WORKSTATION SPECIFICATIONS.....	29
9.1	MVXR Workstation Features.....	29
9.2	MVXR Workstation Specifications.....	30
10.0	APPENDIX C: MATRIX NETWORK SPECIFICATIONS.....	31
10.1	Matrix Network Features .....	31
10.2	Matrix Network Specifications .....	32

## 1.0 GENERAL OVERVIEW

Rapiscan Systems is a leading provider of security screening technology to the aviation security market. With extensive international experience in the sale, delivery, commissioning, and service of advanced, mission-critical systems to airports around the world, Rapiscan Systems has a unique and deep understanding of the operating environment of a world class International Airport.

The following document provides a technical description of the MVXR5000 X-Ray scanner, and its:

- Multi-level Screening Principles
- MVXR5000 system Configurations
- MVXR5000 systems and components
- Features and functions
- Specifications

## 2.0 MVXR5000 SYSTEM PRINCIPLES

The MVXR5000 Scanner is has been optimized and designed for use in a Hold Baggage Screening (HBS) environment. This design uses a proven multi-layer screening operational concept, to provide the most optimized use of automated explosives detection technology systems to screen for possible threats in an aviation security environment.

The need for a multi-view HBS system came about to address the following areas:

- Provide automated detection of explosives compounds through use of advance detection algorithms
- Provide better screening alternative to bag repositioning
- Provide a high level of security screening without compromising increased capacity and throughput

The multi-level screening environment requires at a minimum:

- Level 1 X-Ray scanner providing automatic detection of explosives threats
- Level 2 Human operator review of bag images “uncleared” by the Level 1 automated system
- Level 3 Manual inspection of bags “uncleared” by the system or operators

## 2.1 **Multi-Level Screening**

The following describes a typical multi-layer screening operation.

### 2.1.1 **Level 1 Screening: Automated Explosives Detection**

Level 1 screening is defined as an X-Ray scanner providing automated detection of explosives threats.

The Level 1 X-Ray scanner is responsible for first pass screening and analysis of bags introduced through the system. All bags are screened through Level 1, and are classified “cleared” or “uncleared” by Level 1.

Bags which are considered non-threat by the Level 1 automated system are tagged “cleared”, and should continue to their destination without further screening

Bags which are considered as having potential threats by the Level 1 automated system are tagged “uncleared”. The images of the bags “uncleared” by the Level 1 system will be sent to the next Level 2 for further operator analysis.

### 2.1.2 **Level 2 Screening: Human Operator Analysis**

Level 2 screening is defined as a Screener providing operator analysis of bags flagged “uncleared” by the Level 1 system.

The level 2 operator screener is responsible for human analysis of bags considered to contain potential explosive threat. The operators conduct their analysis on operator workstation dedicated to displaying the “uncleared” images on the screens. Numerous tools are available to enhance the image and help the operators in making their decisions analysis

Bags which are considered non-threat bags by the Level 2 Operator are tagged “cleared”, and should continue to their destination without further screening

A small percentage of level 1 “uncleared” bag will be classified at Level 2 as potentially containing explosive threats. These bags which have been flagged as “not cleared” by the screeners will be diverted to the next level of screening at level 3 for further analysis.

### 2.1.3 **Level 3 Screening: Additional screening**

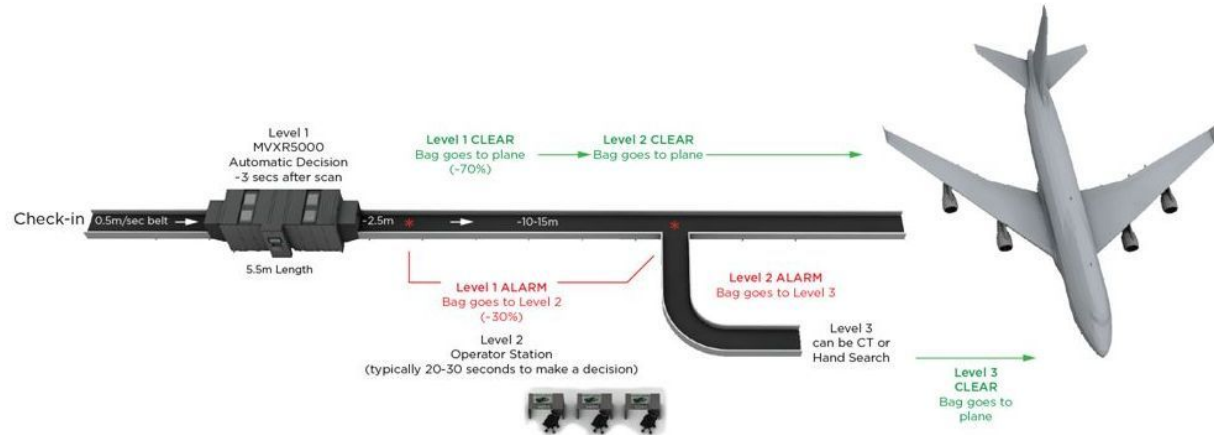
Level 3 screening is defined as being any number of different screening methods, which will provide additional screening of Level 2 “uncleared” bags. Applied methods could include using:

- Bag repositioning - Re-scan of bags through X-Ray system
- Utilizing Standard 3 Tomography systems
- Sniffers and Trace Detectors
- Security manual search, and
- Searches by dogs

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

## 2.2 MVXR5000 HBS System Typical Operation

The following describes a typical MVXR5000 Hold Baggage operation for aviation application.

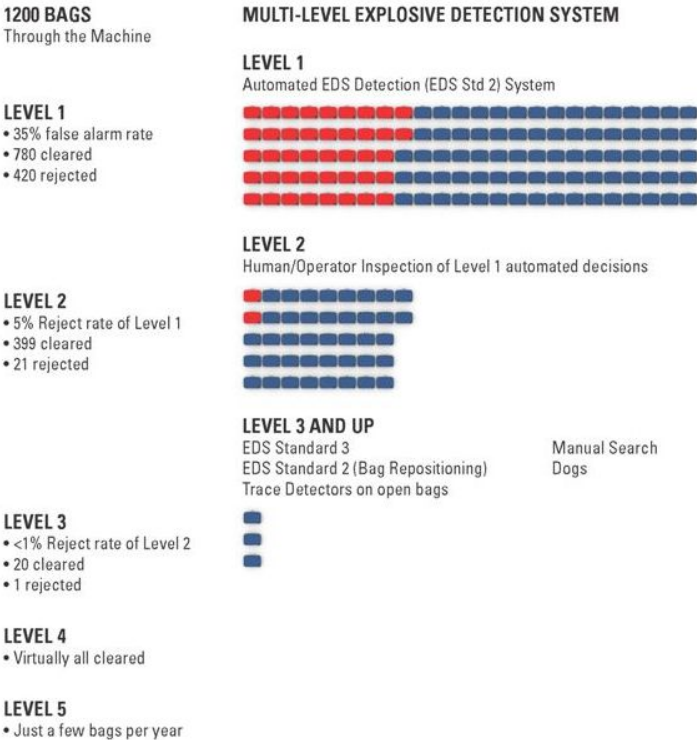


1. The check-in counters processes passenger check-in bags, and introduces bags onto Baggage Handling System (BHS).
2. 100% of bags will be delivered to the MVXR5000 Level 1 X-Ray Scanner.
3. MVXR5000 X-Ray system will scan all bags and provide the Level 1 automated analysis.
  - a. Level 1 "Cleared" bags will go to community clear carousel for load onto planes.
  - b. Level 1 "Uncleared" bags images will be queued for Level 2 operators.
4. Level 2 Operators will have a limited time to analysis the "uncleared" bags, and provide a operator decision.
  - a. Level 2 "Cleared" bags will go to community clear carousel for load onto planes.
  - b. Level 2 "Uncleared" bags will be directed to the Level 3 for further screening.
5. Level 3 manual search personnel provides further inspection of physical bag using any number of different screening techniques.

**2.3 Multi-level Screening Scalability**

The effectiveness of a multi-level screening system is highlighted by providing a scalable solution to manage high capacity passenger throughput without compromising a high level of security screening.

At each level of screening, the percentages of bags requiring screening are a fraction of the total bags processed. This becomes less at each subsequent level, as the “uncleared” bags are reviewed and “cleared”. Employing the Level 1 scanners automated detection, this multi-level screening design is a highly effective way of maintaining a high level of security, with smaller number of resources.



**2.4 Baggage Handling System (BHS) Integration**

The multi-level design employed by the MVXR5000 is most optimized when integrated with a full Baggage Handling System (BHS) system. The BHS is a conveyor delivery system that transports bags to the X-Ray scanners, and manages the bag routing to their expected destinations. The MVXR5000 systems are closely integrated with the BHS, and communicate system status, bag identifications, and system decisions. MVXR5000 X-Ray scanners use industry standard communication protocols and interface ports to allow full integrating with many BHS systems.

Reference the latest released of the Baggage Handling System (BHS) Interface Specifications document for the most up to date specifications (RAPISCAN Doc. # 04108950).

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

### 3.0 MVXR5000 X-RAY SCANNER OVERVIEW

The MVXR5000 X-Ray Scanner system is at the core of the MVXR5000 Hold Baggage System (HBS). The system was designed to be compliant for use as a Level 1 automated explosive detection system, and able to fully integrate with BHS conveyor systems



The MVXR5000 X-Ray Scanner is a high-resolution, dual-energy, multi-view systems. The five independent views provide the most optimal means of bag scanning, regardless of where or how the bag orientation and position are inside the system, and supply the certified detection algorithms a more effective means to perform the Level 1 automated detection. The fully optimized 5 view design and L1 analysis capabilities are what gives the MVXR5000 system to provide a high level of screening, at a rate of up to 1800 bags per hour.

#### **Key Features**

- Multi-view (5 independent view) system
- Standard Test Piece (STP) compliant
- Threat Image Projection (TIP) compliant
- Flexible interfacing
- Scalable network design
- Long bag analysis (up to 1.6m)
- Long bag imaging (up to 3.6m)
- Image archiving
- System fault reporting

#### **Multi-view System**

Superior detection with true 5 angular views allows better performance for the detection of materials in configurations typically difficult to resolve on high-speed X-Ray systems. Fast reconstruction algorithms are used to determine the presence and position of threats based upon context, material density, size, and effective atomic number. These threat alarms are visually highlighted for secondary operator review



**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

**Standard Test Piece (STP) compliant**

At least 3 views are Standard Test Piece (STP) compliant

**Threat Image Projection (TIP) compliant**

The MVXR5000 HBS system has full support for aviation standard Threat Image Projection (TIP) system.

**Flexible BHS interfacing**

The MVXR5000 was designed to meet and exceed international BHS interface standards, with real proven track records of integration with all major BHS vendors

**Scalable network design**

The MVXR5000 was designed to be fully scalable to meet any operational needs. The core MVXR5000 system can be configured to operate as a single system, single system integrated with the BHS, or as broad as multiple systems with multiple workstations to accommodate robust traffic needs.

**Long bag analysis**

The MVXR5000 system supports Level 1 analysis of long bags (up to 1.6m in length). Industry leading Level 1 analysis can be used for out-of-gauge (longer than standard) bag scanning applications.

**Long bag imaging**

The MVXR5000 system supports imaging bags that are 3.6m in length for out-of-gauge (OOG) applications. The bags between 1.6m in length to 3.6 in length will be processed for image display, but will not be processed by the automated detection algorithm.

**Imaging archiving**

The MVXR5000 system supports automated image archiving of all bags scanned by the scanner. Archived images can be retrieved for further image review.

**Fault reporting**

The MVXR5000 system self monitors its subsystems and provide fault reporting. If any faults or warnings are detected, the system can be configured to output or alert in a specified manner based on user defined settings

## 4.0 OPERATOR WORKSTATION OVERVIEW

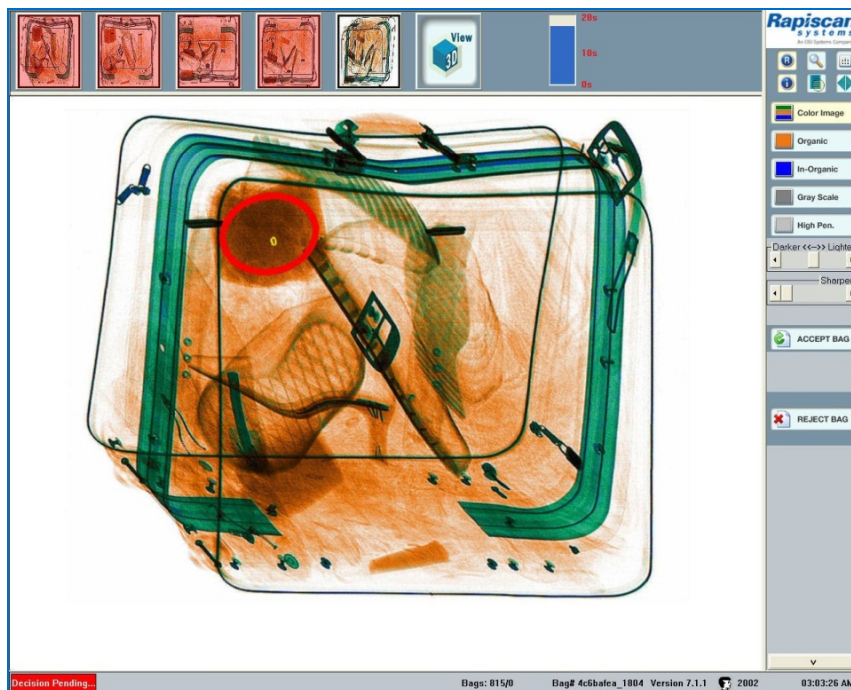
The Level 2 screener utilized the Operator Workstation to conduct their image review of images presented to them. The Workstations employ a Graphics Driven Interface (GUI) with keyboard and mouse interface to facilitate the images review.

The user interface give full access to the five (5) view captured by the MVXR5000 system and all image enhancement tool sets including zoom, lighten/darken, sharpen, inorganic, organic, color, black/white, high penetration, inverse, and many more

Bags presented to the Workstations will provide visual indication that potential threats have been detected, and assist the operators in focusing on those areas. Views that have been detected with potential threats will display as red highlight thumbnails on the user interface so operators can quickly, jump to the suspected view. Once operators have selected the view of interest, the main window will display the view in full view, and display ellipsis enclosing the area of suspect

### Key Features

- Graphic driven user Interface (GUI)
- Dual Energy Imaging
- Image enhancing tools
- Decision timer
- Decision buttons
- Operator status bar



**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

### **Graphic driven User Interface (GUI)**

The Operator Workstation provides a user friendly graphics user interface with easy mouse driven icon selections. The interface layout gives quick access to all common image enhancement tools without reverting to a different screen, so the focus is maintained on the image analysis

### **Dual Energy Imaging**

Dual energy image means materials of different density are displayed with different colors on the workstation monitor.

<b>Orange:</b>	Organic Material
<b>Blue:</b>	Inorganic Material
<b>Green:</b>	Organic-Inorganic Material
<b>Black:</b>	Opaque Material ("Shield")

### **Image enhancement tools**

Image enhancement tool set allows full manipulation of the bags displayed on the main screen. Some enhancements could be combined for user defined enhancements. Crystal Clear is a Rapiscan proprietary image enhancement setting calibrated for best image display

- Black/White
- Crystal Clear
- Contrast
- High/Low penetration
- In-organic stripping
- Organic stripping
- Sharpen
- Variable Gamma
- Zoom

### **Decision Timer**

Level 2 screeners can view information from either the high or low energy detector arrays. The low penetration mode enhances the display of low-density objects whereas high penetration mode enhances the display of high-density objects.

### **Decision buttons**

Clear button options to "Accept" operator cleared bags, or "Reject" operator uncleared bags for further review

### **Operator Workstation Status**

The user interface status provides useful information include bag counters, logged in user ID, current software version, and date and time information.

## 5.0 MATRIX NETWORK OVERVIEW

The MVXR Matrix Network allows the MVXR5000 scanners to be scalable and conform to many operational designs. The Matrix Network provides the central backbone and acts as the dataflow manager for communication between the MVXR5000 scanners and the Operator Workstations.

The Matrix Network system includes at the core the servers, console, and network switches that support the multiple MVXR5000 scanners, and multiple Operator Workstations. The robust nature of the server based technology means built in component redundancy, and a higher reliability.

### **Key Features**

- Fully scalable network (supports multiple MVXR5000 systems and Workstations)
- Built in component level redundancy
- Expanded feature sets and functionality
- Dedicated lockable server cabinet

### **Full Scalable Solution**

The Matrix Network was designed with scalability in mind, able to accommodate a varying number of MVXR5000 and Operator Workstations configurations. This simple design allows MVXR5000 systems and Workstations to be deployed from large high capacity site, to the small low throughput sites.

### **Built in component level redundancy**

The servers are delivered with component level redundancies built in, including redundant CPU, error correcting memory (ECC), redundant power supplies, network nodes, and hard drives in RAID configuration. Redundant 1Gb network switches serve as the backbone of the Matrix network, and configure to operate in fault-tolerant specifications. A standard UPS provides uninterruptable power in case of a unexpected power outage

### **Expanded feature set and functionality**

The Matrix Network has support for advance features and functions include support for:

- Image Archiving
- Level 3 Workstation
- Threat Image Projection
- Supervisor (Admin) Workstation

### **Dedicated lockable server cabinet**

The core Matrix servers, switches, server console, UPS are all protected within a lockable and secure rack cabinet. The lockable cabinet provides extra assurance and piece of mind that the core systems will not be exposed to direct tampering

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

## 5.1 Matrix Servers

Due to the high demands and data processed, each Matrix Server is dedicated to singular functions. The servers and functions are explained below

### 5.1.1 MIS Server

The MIS Server houses the centralized database for the MVXR Matrix Network system. The database maintains the user accounts information, bag indexes, decision, and is the source for all statistical reporting data. .

### 5.1.2 NET Server

The NET Server manages the data flow, and communication between all the MVXR5000 scanner systems, and the Operator Workstations. The NET Server screen displays the MVXR5000 systems that are connected, and display operators once they are logged onto their workstations and ready.

The NET Server polls the MVXR5000 system for the list of images requiring further analysis, and sends them to available or free Operator Workstations not currently busy. This principle of “load balancing” allows the system to distribute images across the multiple workstations, allow for better usage of available resources. If all Operator Workstations are busy with images, the NET Server queues the images until an available Operator Workstation is available to receive the image.

The NET Server also provides real-time statistics of the scanners, operators, and bags counts.

The screenshot displays the Matrix Monitor interface with several data tables and summary panels.

**Systems Information Table:**

MVXR #	Bags	L1 Accepts	L1 Rejects	L1 Accept + L2	Default L2	L2 Accepts	L2 Rejects
2	22242	14826	7414	0	0	3849	3955
3	22276	14950	7425	0	0	3740	3677
4	22277	14951	7426	0	0	3522	3903
5	22266	14845	7421	0	0	3296	4125
6	22289	14846	7423	0	0	3969	3495
7	21406	14270	7136	0	0	3584	3552
8	22209	14905	7402	0	0	3620	3703

**Available Operator Performance Table:**

LogOn ID	Level	Bags	Accepts	Rejects	TIP Bags	Hr
3000	3	14790	7394	7395	0	0
2020	2	2558	1307	1251	293	157
2019	2	2578	1257	1311	290	145
2018	2	2956	1272	1284	291	151
2017	2	2543	1238	1305	296	148
2016	2	2594	1274	1320	296	133
2015	2	2575	1312	1263	295	148
2014	2	2644	1242	1302	298	135
2013	2	2597	1289	1266	292	157
2012	2	2591	1286	1305	295	161
2011	2	2595	1260	1325	291	146
2010	2	2596	1289	1307	293	152
2009	2	2563	1216	1347	290	146
2008	2	2586	1285	1321	301	149

**System Details:**

IP Address	192.168.0.20	Start Time	2012-09-17 12:59:14	End Time	--	Status	Online
MVXR #	2	No. Of Bags	22242	L1 Accepts %	68.67	L1 Rejects %	33.33
L1 Rejects %	0.00	Secure-Mode-A Bags %	0.00	Secure-Mode-B Bags %	100.00	L2 Accepts %	51.50
L2 Rejects %	48.08	L2 Accepts %	28.20	L3 Rejects %	71.79		

**Summary Statistics:**

TIP Server Connection	57	TIPs Projected	5670	TIPs Scheduled	5670	TIPs Aborted	220	TIP Decisions	5670	Hrs	2914	Misses	2956	Timeouts	0
-----------------------	----	----------------	------	----------------	------	--------------	-----	---------------	------	-----	------	--------	------	----------	---

**Bag Information Summary:**

- Total MVXR Systems: 7
- Total Bags: 154955
- Level 1: Accepted Bags 103295, Rejected Bags 51660
- Level 2: Available Operators 20, Accepted Bags 25613, Rejected Bags 26046, Default Rejected Bags 0, Force Rejected Bags 0
- Level 3: Available Operators 1, Accepted Bags 7394, Rejected Bags 7395, Default Rejected Bags 11250

**L2 Operators Information:**

LogOn ID	Status
2020	Busy
2019	Free
2018	Free
2017	Free
2016	Free

**L3 Operators Information:**

LogOn ID	Status
3000	Busy

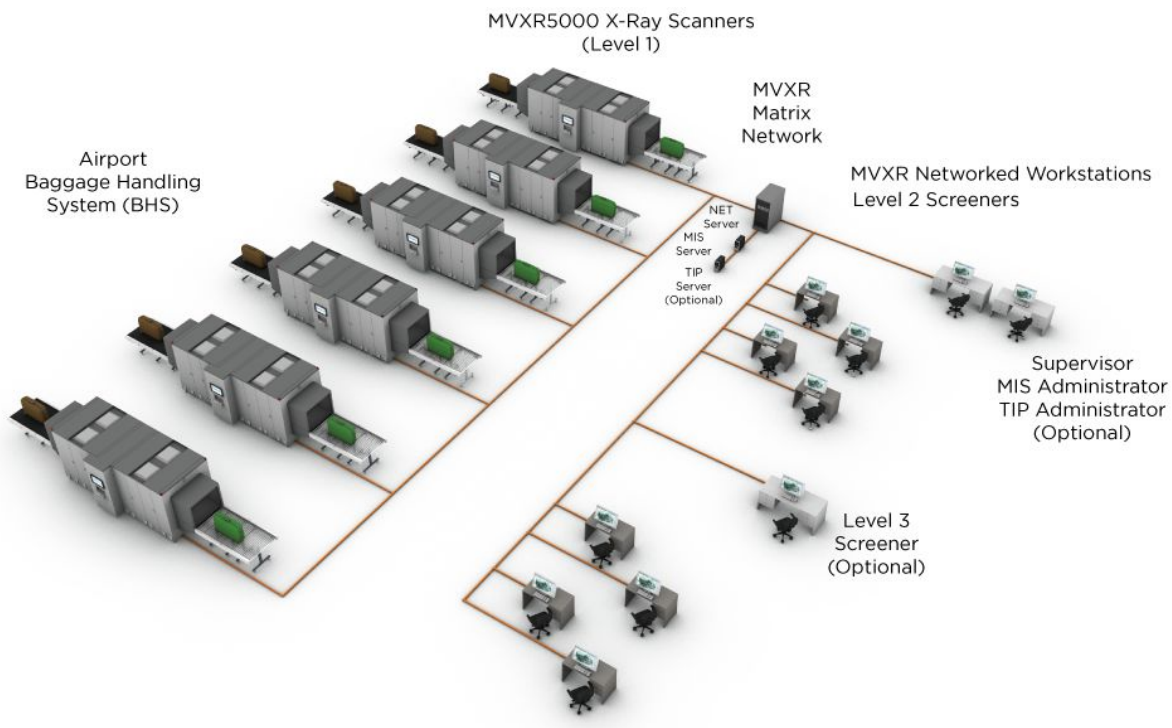
## 6.0 MVXR5000 SYSTEM CONFIGURATIONS

The MVXR5000 X-Ray Scanners can be configured in any number of scalable solutions for Hold Baggage Screening (HBS) application. Below we provide additional details on available configurations.

### 6.1 Matrix Network Configuration

The Matrix Network configuration incorporates one or more MVXR5000s and multiple Level 2 Workstations that are fully integrated with a Baggage Handling System. This configuration provides the most robust and scalable offering, and can be employed in small to large HBS screening environments.

MVXR5000 Level 1 decisions are communicated to multiple networked workstations at Level 2, through the MVXR Matrix Network equipment, which manages the increased data and network demands.



#### **Supported Configurations:**

- 2 x MVXR5000 Scanners
- 4 x Operator Workstations
- Standard Level 1 / Level 2 Screening
- Image Archiving
- Level 3 Operator Workstation
- Supervisor (Admin) Workstation

## 7.0 FEATURES / FUNCTIONS

### 7.1 Standard Level 1/ Level 2 Screening

Level 1/Level 2 security screening is at the core of the MVXR5000 screening principles. In all configuration or application, bags are scanned through the MVXR5000 system and will be analyzed for threats. The following provides a description of a standard Level 1 / Level 2 Screening process whereby the MVXR5000 is used to provide automated Level 1 analysis:

1. Bags are fed into the MVXR5000 system by either a BHS system or manually loaded by personnel
2. The bags travels through the MVXR500 tunnel, and is scanned by all 5 angular views as it passes through their scanning planes
3. After a bag has fully crossed the view 5 angled scanning planes, the view images are collected and analyzed in by the certified detection algorithm for any potential threats
4. The resulting Level 1 analysis takes no more than 10 seconds
  - a. If a bag analysis is determined to be “cleared”, the MVXR will display the results on the screen, and communicate the Level 1 decision signal to any integrated Baggage Handling System (BHS).
  - b. If a bag analysis is determined to be “uncleared”, the bag image are queued for retrieval by an available Level 2 Operator Workstation
5. The images will be presented to the Level 2 for Operator analysis of the bag.
6. Operator decisions will be returned to the MVXR5000 system, and communicated to the BHS through the decision channels, so the bags can be routed to the correct destinations

**Key Features:**

- Only Level 1 “uncleared” bags are available for Level 2 Operator Screening
- Proven high security screening design
- Scalable solution for small to large environments
- Supports full integration with Baggage Handling System

## 7.2 Image Archiving System

The MVXR5000 HBS system has support for the optional automated image archiving of all images processed by the MVXR5000 systems. The archived images can be queried and viewed from the Supervisor (Admin) Workstation

With the Image archiving in place, all images scanned by the associated MVXR5000 system will be stored on their dedicated Archive Servers.

**Key Features:**

- Archived images are stamped with ID, Date, and Time
- Images are archived on dedicated archive servers on each MVXR
- Support storage capacity of average 60,000\* images per system
- User-defined archiving capacity settings

**Notes and Requirements**

- Optional Archive Server hardware required for functionality
- Optional Supervisor (Admin) Workstation required for image archive review

\*calculations are made with average type bags

## 7.3 Supervisor (Admin) Workstation

The Supervisor (Admin) Workstation system provides a single access management system whereby a supervisor level administrator can access and view and generate statistical reports on the operation of the MVXR5000 HBS System from a centralized system. The Supervisor (Admin) Workstation is given the interface to access and review archived images

**Key Features:**

- Centralized management and reporting (TMAS/MIS)
- Image archive replay (Full image enhancement tools available)

**Notes and Requirements**

- Optional Supervisor Workstation equipment is required for functionality.

**Centralized Management and Reporting**

The Supervisor workstation unifies and centralizes all available MVXR5000 management tools and resources together onto a single system, without the need to access the secure Matrix servers. Reports include statistic on Level 1, Level 2, Operator, and Level 3 statistics. View report on our easy to navigate report viewer, or export report for external viewing. The reporting system is integrated with all MVXR5000 systems to provide status report and warnings

**Image Archive Replay**

Access and review archive images remotely from the Supervisor Workstation. The graphics user interface gives the Supervisor the full range of image enhancements, without the restriction of a decision time.



**7.4 Level 3 Operator Screening**

Further extending the multi-level screening design, the MVXR5000 HBS system can support a Level 3 screening environment. Level 3 Operator Screening is typically allows a more seasoned operator to review images of “uncleared” Level 2 Operators decisions. The Level 3 Operator is provided the same operator screening interface as the level 2 screener, and can provide further analysis.

The Level 3 Workstation can similarly be used at the manual search area to assist in the manual search of bags “uncleared” by the Level 2 Operators

**Key Features:**

- Low cost Level 3 solution for site requiring additional screening levels
- Unlimited review times
- Full range of image enhancement tools

**Notes and Requirements**

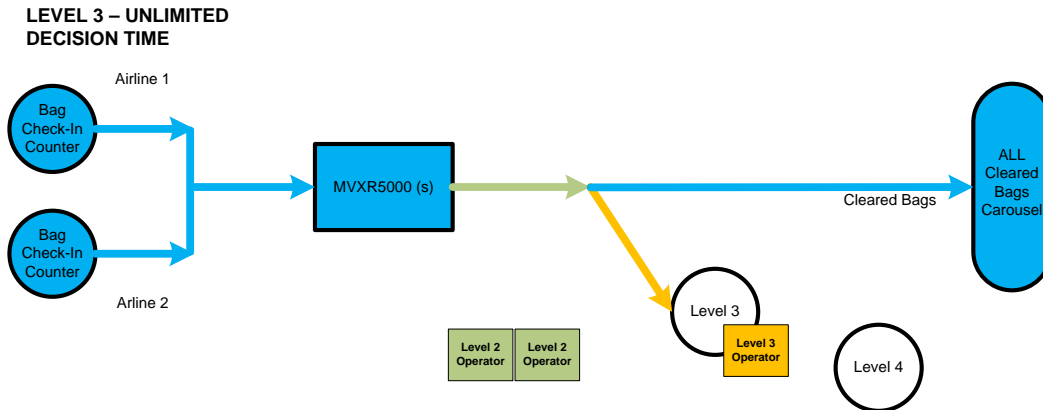
- Optional Level 3 Workstation equipment to provide functionality
- Supports only 1 Level 3 Operators Workstation
- Image displayed at the Level 3 Workstation may not be in the same order as those presented by the BHS conveyor system to the inspection area

Features	Unlimited Time
Equipment	More simple BHS equipment
Time bar	No decision time bar
Image Queuing	Image is queued on HD until manual operator decision
Level 3 Decision	Decision are <b>NOT</b> routed to BHS, and will display next bag
BHS Integration	Level 3 bags has to be manually manipulated
Operators	Support for <b>only</b> 1 Level 3 Operator Workstation

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

**Case Study: Level 3 Screening**

The following case study illustrates utilizing a Level 3 Workstation at the Level 3 Manual search area to assist in identifying the area of interest.



1. Bags are fed into the MVXR5000 system by either a BHS system or manually loaded by personnel
2. The bags travel through the MVXR5000 tunnel, and are scanned by all 5 angular views as they pass through their scanning planes
3. After a bag has fully crossed the view 5 angled scanning planes, the view images are collected and analyzed by the certified detection algorithm for any potential threats
4. The resulting Level 1 analysis takes no more than 10 seconds
  - a. If a bag analysis is determined to be “cleared”, the MVXR will display the results on the screen, and communicate the Level 1 decision signal to any integrated Baggage Handling System (BHS).
  - b. If a bag analysis is determined to be “uncleared”, the bag image is queued for retrieval by an available Level 2 Operator Workstation
5. The images will be presented to the Level 2 for Operator analysis of the bag.
  - a. If the Level 2 Operator determined to be “cleared”, the decision is returned to the MVXR, and communicated to the Level 1 decision signal to any integrated Baggage Handling System (BHS).
  - b. If a bag analysis is determined to be “uncleared”, the bag image is queued for display on the Level 3 Operator Workstation (orange line), while actual physical bag is
6. Level 3 bags are displayed for the Level 3 Operator (no decision time bar) to assist operators in their manual search of the bag
7. Level 3 Operators will follow site operational protocols upon determining if a threat exists or not

## 8.0 APPENDIX A: MVXR5000 SPECIFICATIONS

### 8.1 MVXR5000 System Features

#### **Key access to System and Control Console:**

Key access is needed to power-up the MVXR5000 X-Ray systems providing additional security towards preventing unauthorized operation of the equipment. Built-in lockable Control Console located on the side of the unit, ensure a high level of security is maintained.

#### **X-Ray “ON” Warning Lights:**

Located at the front and back top corners, the lit lights indicate when the X-Ray generators are ON

#### **Power “ON” Indicator:**

Green light lit indicates the MVXR5000 X-Ray Scanner unit is powered ON

#### **Leaded Shroud Curtains**

Tunnel entrance and exit curtains limit scattered radiation up to 1 $\mu$ Sv/h.

#### **Emergency Stop Switches**

E-Stop buttons on all 4 corners of the machine enable immediate manual shut down of the X-Ray generators and conveyor movement

#### **Safety Interlocks**

These stop the x-rays when the array covers are open. X-Ray re-starts when the covers are fully closed and the MVXR5000 resets.

#### **Flexible Conveyor / Shielding Options**

A range of conveyor and external shielding options are available to allow for the MVXR5000 X-Ray Scanner to fit into existing installations with reduced impact.

#### **Designed for Easy Maintenance and Access**

The MVXR5000 system was designed to provide easy access for maintenance personnel. Diode array boxes are sealed using thumbscrews. Diode array boxes are hinged to allow easy access and maintenance. Software diagnostics and error logs are built to allow comprehensive systems diagnostics and troubleshooting.



## 8.2 MVXR5000 Design and Quality Standards

Reference Number	Title	Issuing Agency
ISO 9001	Standards for Quality Management Systems	ISO (Global)
BS EN 60950-1:2006	Information Technology Equipment Safety: General Requirements	BSI British Standards Institute (UK)
89/392/EEC (Amended 98/37/EEC)	Machinery Directive	Council of the European Communities
Machines directive 98/37/EC	Machinery Directive / Medical Devices Directive	European Parliament and the Council of 22 June 1998
BS EN 60204-1:2006	Safety of Machinery: Electrical Equipment of Machines, General Requirements	BSI British Standards Institute (UK)
BS 2754:1976	Memorandum: Construction of Electrical Equipment for Protection against Electric Shock	BSI British Standards Institute (UK)
c UL 187	UL Standard for Safety for X-Ray Equipment	Underwriter Laboratories (UL)
CSA114	CSA C22.2 NO 114-M90-CAN/CSA Diagnostic Imaging and Radiation Therapy Equipment	Canadian Standards Association
BS PD 5304:2005	Guidance on Safe Use of Machinery	BSI British Standards Institute (UK)
BS EN 418:1992	Safety of Machinery: Emergency Stop Equipment, Functional Aspects, Principles for Design	BSI British Standards Institute (UK)
BS EN 1037:1996	Safety of Machinery: Prevention of Unexpected Start-Up	BSI British Standards Institute (UK)
BS EN 292-1:1991	Safety of Machinery: Basic Concepts, General Principles for Design; Basic Terminology, Methodology	BSI British Standards Institute (UK)
BS EN 292-2:1991	Safety of Machinery: Basic Concepts, General Principles for Design: Technical Principles and Specifications	BSI British Standards Institute (UK)

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**



Reference Number	Title	Issuing Agency
(IRR99) No. 3232	<p>Ionizing Radiations Regulations 1999 (IRR99) No. 3232, Statutory Instrument 1999 No. 3232.</p> <p>Note: Replaced the IRR85/ S.I.1985 No 1333) and the ionizing Radiations (Outside Workers) Regulations 1993 (S.I 1993 No 2379). IRR99 implemented most of the revised Basic Safety Standards Directive (96/29/Euratom) [3].</p>	United Kingdom Government Statutes
Directive 2006/95/EC	<p>Low Voltage</p> <p>Note: Replaced Low voltage directive 73/23/EEC from the Council of the European Communities.</p>	European Parliament and the Council of 12 Dec. 2006
TH 42073	CE Marking for Machinery: A Guide to the European Directive	BSI British Standards Institute (UK)

### 8.3 MVXR5000 X-Ray Scanner Specifications

<b>Name and Model</b>	MVXR5000
<b>X-Ray voltage</b>	170kV for each Transmission X-ray Generator (Quantity 3)
<b>Shipped Machine Dimensions</b>	Machine is shipped in two crates. Dimensions are noted below: (L) x (W) x (H) <u>Crate 1:</u> 3302 mm x 2108 mm x 2311 mm <u>Crate 2:</u> 2515 mm x 1854 mm x 2311 mm
<b>Shipped Packing Weight</b>	Machine is shipped in two crates. Weight are noted below: <u>Crate 1:</u> 3520 kg (7760 lbs) <u>Crate 2:</u> 2230 kg (4916 lbs)
<b>Installed Machine Dimensions</b>	Length: 5,379 mm (211.8 inches) Width: 1,969 mm (77.5 inches) Height: 2,003 mm (78.9 inches)
<b>Weight of Machine</b>	< 5,000kg
<b>Conveyor Height</b>	815 mm ±10 mm (Adjustable)
<b>Tunnel</b>	1,003 mm Wide x 802 mm High
<b>Conveyor Belt Speed</b>	0.5m/sec Continuous
<b>Gap Between Bags</b>	200 mm Minimum (Refer to BHS Interface Specifications Document for examples)
<b>Throughput (Bags Per Hour)</b>	Up to 1,800 BPH Maximum (Refer to BHS Interface Specifications Document for examples)
<b>Minimum Bag Dimensions*</b>	Height: 30 mm Width: 150 mm Length: 300 mm
<b>Maximum Bag Dimensions</b>	Height: 750 mm Width: 950 mm Length: Image with Level 1 Analysis: 1.6m Image displays only: 3.6m
<b>Minimum Bag Weight</b>	5 kg
<b>Maximum Bag Weight</b>	50 kg
<b>Electrical Power Requirements</b>	400 Volts ±10% 50 Hz (3-Phase) <4.5 kW Nominal
<b>Image Quality</b>	STP Compliant in at least Three (3) Views
<b>Penetration</b>	30 mm Steel (Simple)
<b>Resolution</b>	40 SWG (Tinned Copper Wire)

**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

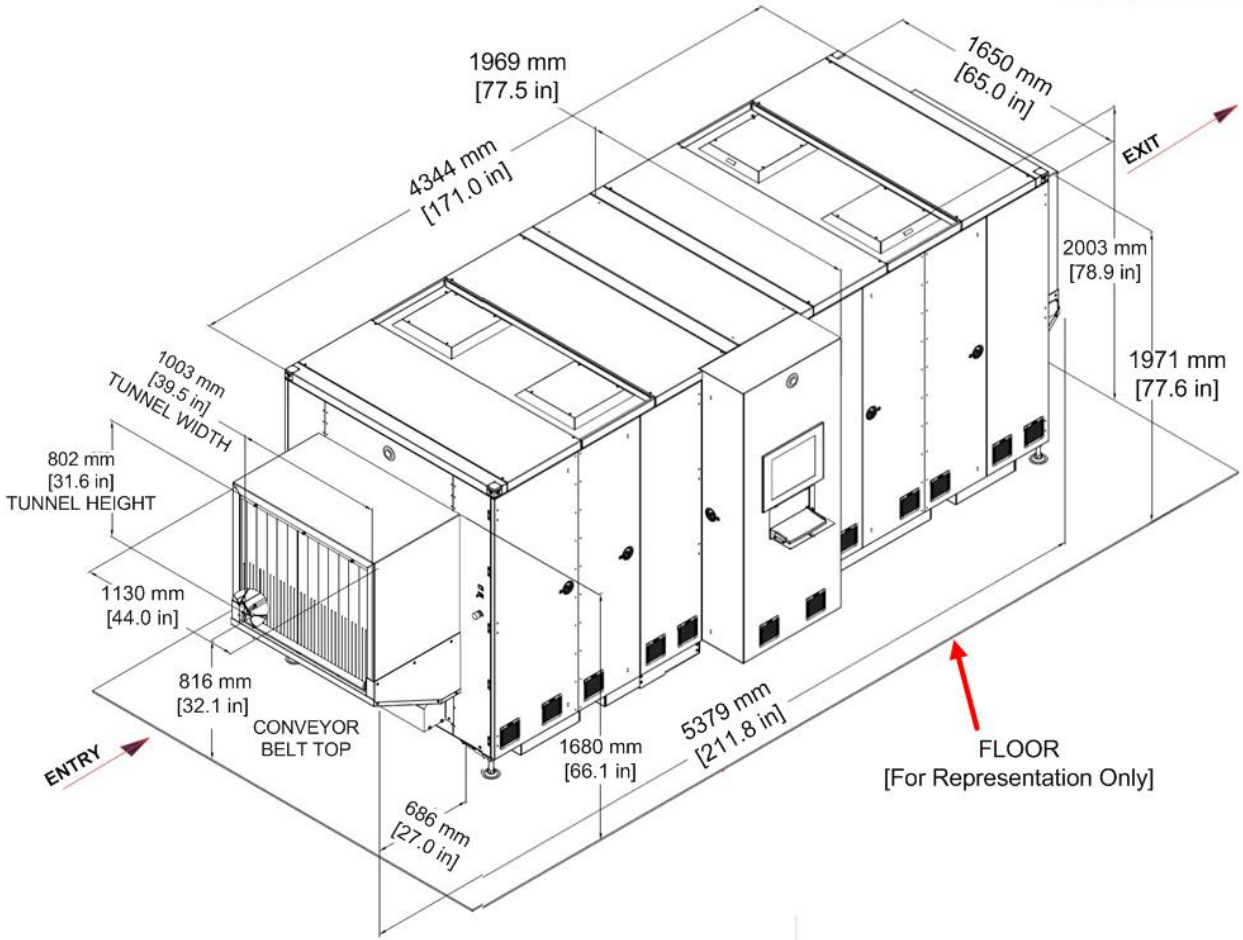


<b>No. of X-Ray Views</b>	3 Transmission X-Ray Generators 5 Views
<b>X-Ray Dose</b>	25 micro Sievert
<b>Film Safety</b>	Per ISO 1600/33 DIN Guaranteed for 10 Passes
<b>Typical Processing Time for an Average Bag</b>	Typical 3 Seconds
<b>Ambient Limitations</b>	Storage:       Between -20° and +50°C Operating:     Between -10° and +40°C Humidity:      Between 10% and 95% Non-Condensing
<b>Noise</b>	68 dB(A) at 1m
<b>Indoor/Outdoor Use</b>	Indoor only

\* Note: Limits are general limits, and could be affected by other factors unrelated to the MVXR5000 system. Reference the latest released of the [MVXR5000 BHS Interface Specifications](#) document for the most up to date specifications (Rapiscan Doc # 04108950).

**8.4 MVXR5000 Dimensions and Modular Design**

Each MVXR5000 is shipped and delivered in two crates, allowing easier shipping and allowing accessibility to smaller sites



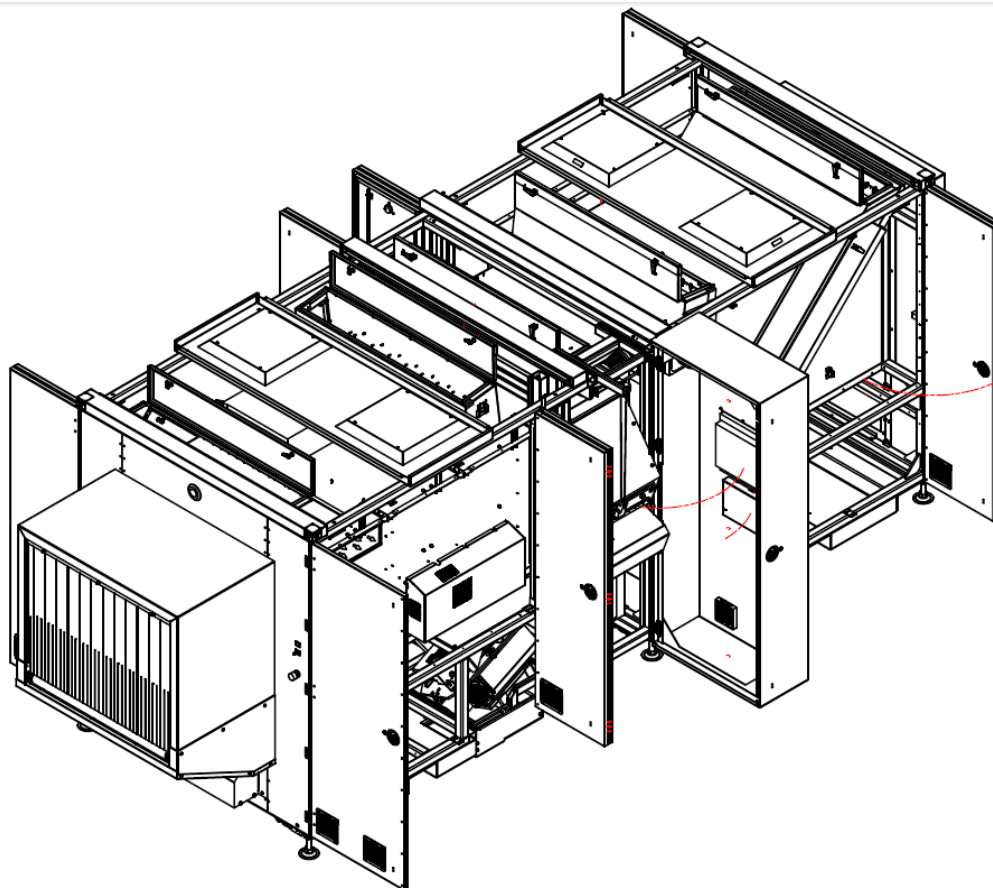


**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

**8.5 MVXR5000 Service Area**

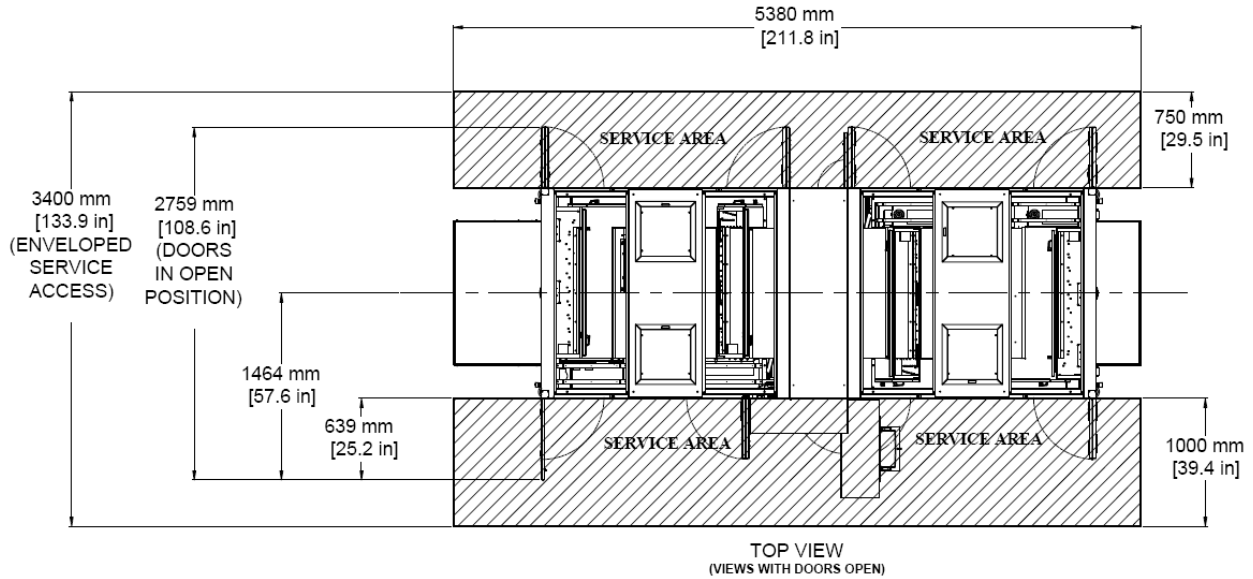
Roof Access	500 mm
Door Panel Access – Front (Control Console) Side	1000 mm
Door Panel Access - Rear Side	750 mm

\*Preliminary drawing (dimension may have difference slightly)

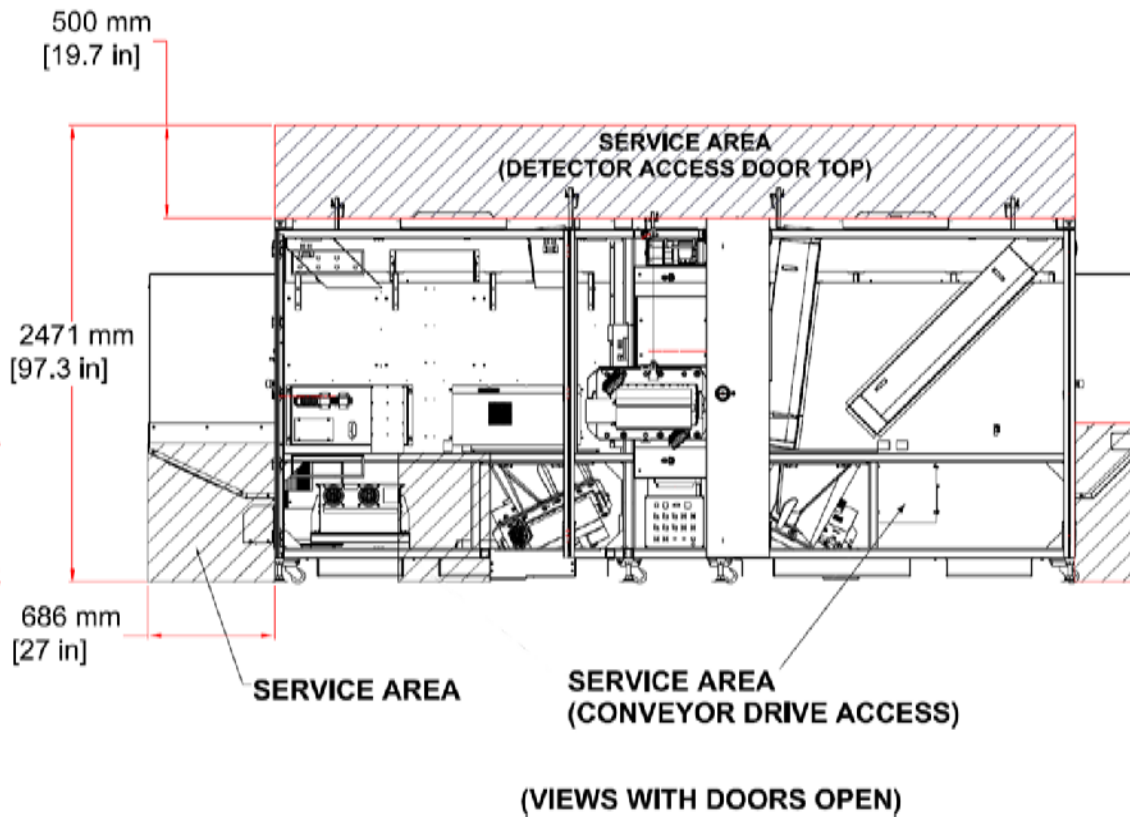


**(TOP COVER PANEL  
VISIBILITY OFF FOR CLARITY)  
SCALE 1:25**

**Top View**

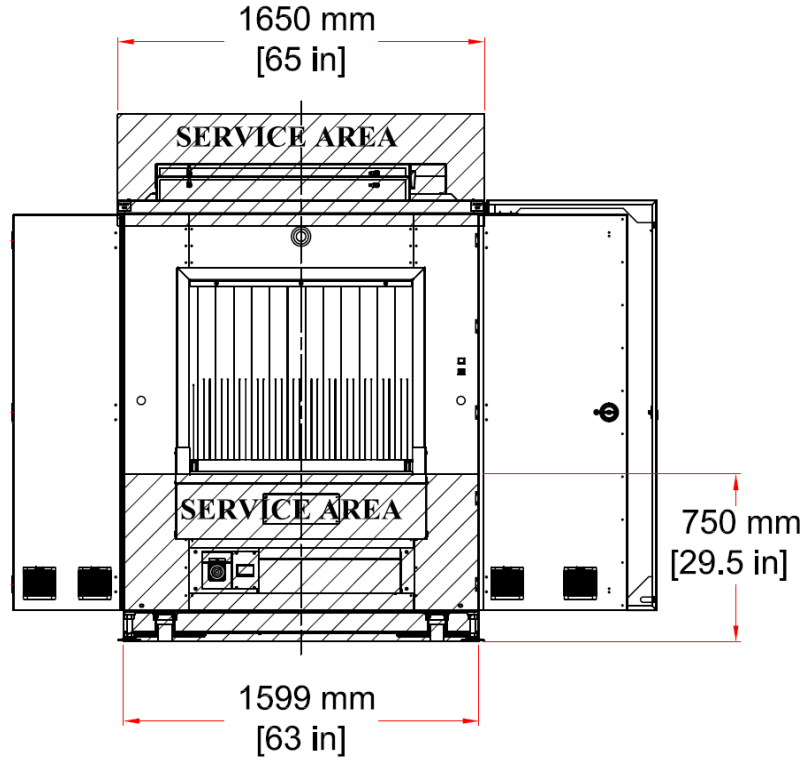


**Side View**

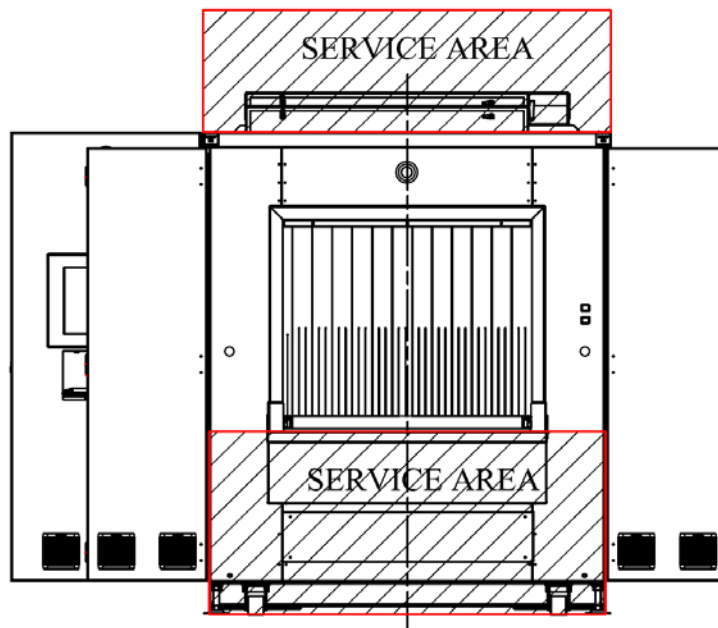


**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**

**Front View**



**Exit View**



**MVXR5000**  
**Hold Baggage Screening (HBS) System**  
**Technical Description**



[This page intentionally left blank.]

## 9.0 APPENDIX B: MVXR WORKSTATION SPECIFICATIONS

### 9.1 MVXR Workstation Features

#### **High-Speed Graphics Computer with a Windows® XP Operating System**

Latest computing power and graphics specifications system on a proven Windows based platform provides exceptional ease of use, maintainability, and manageability

#### **Large 19" Inch Flat-panel LCD Monitor**

Large 19" using LCD technology to bring uncompromising resolution and clarity, without sacrificing desktop space

#### **Windows-Compliant Keyboard and Mouse**

Standard keyboard and mouse interface, provides ease of use and established flexibility to control the graphics driven user interface

#### **Uninterruptible Power Source (UPS)**

Every system has individual UPS to ensure proper graceful shutdown of the OS and its applications in case of an unresolved power failure

#### **User access security features**

Access security to prevent unauthorized access to the OS layer

#### **Operator Control Panel Support**

Support for the optional operator control panel. Operator control panel provides full control of the GUI interface

#### **Operator Workstation Desk**

The optional operator workstation desk provides lockable enclosures for the workstation, easy manageability of wires, and cables for all equipment. Includes an area for mounting the UPS, and LCD Monitors

**9.2 MVXR Workstation Specifications**

<b>MVXR WORKSTATION*</b>	
<b>Processor</b>	Intel Core Duo or higher
<b>Operating Systems</b>	Windows® XP Professional or higher
<b>Chipset</b>	Intel® Chipset
<b>Memory</b>	2GB
<b>Graphics Cards</b>	256MB or higher
<b>Hard Drive Capacity</b>	160 GB
<b>Networking</b>	Intel Gigabit Ethernet (Teamed)
<b>Standard I/O Ports:</b>	VGA, USB 2.0, Serial, Line-in (stereo/microphone), Line-out (headphone/speaker)
<b>Dimensions</b>	H: 40.89cm W: 18.69cm D: 44.50cm
<b>Power Supply</b>	305W Standard Power Supply (120-230V) ENERGY STAR 5.0 compliant
<b>UPS</b>	540 Watts / 800 VA

\*specifications may vary slightly

<b>MVXR WORKSTATION MONITOR**</b>	
<b>Display Size</b>	19" Diagonal TFT LCD Display
<b>Dimensions</b>	16.1 in Width x 7.2 in Depth x 14.3 in Height
<b>Max Resolution</b>	1280 x 1024
<b>Color Support</b>	24-bit (16.7 million colors)
<b>Response Time</b>	5 ms
<b>Interface</b>	Analog (RGB), and Digital (DVI) supported
<b>Compliant Standards</b>	Plug and Play, TCO '03, TCO '99

\*\*specifications may vary slightly

<b>MVXR WORKSTATION DESK***</b>	
<b>Lock</b>	Universal Lock
<b>Construction</b>	Metal construction on casters
<b>Dimensions</b>	1054mm (L) x 652mm (W) x 718mm (L) H

\*\*\*desk is an optional part

## 10.0 APPENDIX C: MATRIX NETWORK SPECIFICATIONS

### 10.1 Matrix Network Features

#### **Rack Mount Console with integrated Keyboard and Track pad**

2U Console provides quick slide in/out concealment of the monitor, keyboard, and track-pad when not in use. Console is the main interface to control the servers, KVM, switches, and the UPS

#### **Compact 17" Inch Flat-panel LCD Monitor**

The LCD provides exceptional resolution and versatility in a compact sized, and fits well inside the console. The LCD is not integrated with the console, and can thus be replaced with any standard 17" LCD unit available.

#### **KVM (Keyboard/Video/Mouse Interface)**

The KVM allow full administration of the server equipment through the use of once keyboard, display, and mouse interface. The KVM supports 4 interface systems

#### **Uninterruptible Power Source (UPS)**

The entire Matrix Network and the supporting equipment is protected for power outages and spikes by a 2850 Watts / 3000 VA UPS. The UPS ensures the proper graceful shutdown of the servers, its OS, and applications in case of an unresolved power failure

#### **Accessibility**

The Matrix Network Cabinet provides easy access to all core components with detachable front, rear, and side panels

#### **Ventilation**

Meshed front and back panels provide more than adequate ventilation for the running components

#### **Cable management**

Cable management versatility with rails ensures that cables are securely tagged, organized, and allow full access to maintain individual servers without disruption to other components.

#### **Secure Lockable Access**

All components are protected from unauthorized access with lockable panels on all sides

## 10.2 Matrix Network Specifications

MATRIX CABINET*	
<b>Capacity</b>	24 U
<b>Dimensions</b>	23.94in Width x 39.3 in Depth x 44in Height
<b>Console</b>	1 U Rack Mount with integrated Keyboard/Track-pad
<b>Monitor</b>	17" LCD TFT Display (1280 x 1024 resolution)
<b>KVM</b>	4 Port
<b>Network Switches</b>	Redundant 48 Port Network Switches (4 port shared fiber optic nodes)
<b>Fiber Optic Cable**</b>	Fiber optic connections standard between MVXR5000 systems and Matrix Server switches  1.25 Gbps bi-directional data links Up to 300m (984.25 ft) for using 62.5/125µm MMF cabling specifications
<b>Fiber Optic** Termination</b>	SC (MVXR5000) to LC (Matrix Switches) connections
<b>Cooper Cables</b>	Ethernet CAT6 cables between Matrix Switches and other components
<b>Power Inputs</b>	230V or 120V
<b>UPS</b>	2850 Watts / 3000 VA

\*specifications may vary slightly

\*\*fiber optic modules are and only required for distances beyond 100m

MATRIX SERVERS***	
<b>Redundant Processor</b>	E5540 Xeon Processor, 2.53GHz 8M Cache, Turbo, HT, 1066MHz Max Memory
<b>Memory</b>	24 GB Memory 1066MHz Dual Ranked RDIMM
<b>Hard Drive</b>	3 x 146GB SAS
<b>Hard Drive Controller</b>	SAS RAID Controller
<b>Operating System</b>	Windows Server
<b>NIC</b>	Intel Gigabit ET Dual Port NICPCIe-4
<b>DVD-ROM Drive</b>	DVD ROM, SATA, INTERNAL
<b>Form Factor</b>	Rack Mount (2U)
<b>Power Supply</b>	High Output Power Supply Redundant, 870W

\*\*\*specifications may vary slightly