# PROJECT MANAGER FORCE PROJECTION

## Robotics Portfolio Overview
## to
## NDIA Robotics Division
## 25 AUG 15

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PM Force Projection

# Framing the Army's Draft Robotic and Autonomous Systems (RAS) Plan

As the Army articulates RAS integration across multiple Warfighting Functions, this vision must also show ***realistic objectives*** in the **near-term**, ***feasible objectives*** in the **mid-term,** and ***visionary objectives*** for the **far-term.** Beginning with near-term objectives, each successive phase links its objectives to and builds from the achievements of the previous phase.

**Near-Term Vision- *Adapt***

***Near-Term Objectives:***

- *Leader-Follower Convoy Technology Employment*
- *Lighten the Soldier load*
- *Enhance stand-off from threats and improve situational awareness*

***Mid-Term Objectives:***

- *Technologies improve the **autonomy** of unmanned systems*
- *Technologies will enable unmanned cargo delivery*
- *Robots act as "teammates" rather than tools*
- *Micro autonomous air and ground systems will also enhance Platoon, Squad, and Soldier situational awareness*

**Mid-Term Vision (F2025)- *Evolve***


Source for All Listed Objectives: **TRADOC Pam 525-3-1, *Army Operating Concept*, Appendix C-2.**

***Far-Term Objectives:***

*Technologies will **enable manned and unmanned teaming in both air and ground maneuver** though investments in scalable sensors, scalable teaming, **Soldier-robot communication**, and shared understanding through advancements in machine learning.*

**Far-Term Vision- *Innovate***

# PEO CS&CSS RAS Vision

- Evolutionary approach toward delivering autonomy enabled Warfighter capabilities to reduce operational risk
- Technology (software & hardware) enhancements are seamless & affordable to field standoff capability & intelligence to existing systems
- Deliberate management of program risk
- Affordable & timely programs
- Modular, open architecture design philosophy
- Innovative industrial base & acquisition environment

# PEO CS&CSS Robotics Overview

Man-Transportable Robotics System Mark II (EOD)

M160 Light Flail

Mine Protected Clearance Vehicle (MPCV)

High Mobility Engineer Excavator, Type I (HMEE-I)

Semi-Autonomous Control

Route Clearance & Interrogation System

Robotic Enhancement Program

Common Robotic System Individual

Man-Transportable Robotics System Increment II

Leader/Follower

Husky Mounted Detections System

| Talon IV | Packbot 510 FASTAC | SUGV 310 Mini-EOD | Dragon Runner | First Look |
|---|---|---|---|---|
|  |  |  |  |  |

Non-Standard Equipment

Squad Mission Enhanced Transport

Automated Convoy Operations

# MTRS Inc II Base and Payload Configuration

MTRS Inc II CPD 15 May 2013

Fiber Optic

Optics

Radios

**Common Payloads ( All Users)**
PdM Unmanned Ground Vehicles
(PEO CS&CSS)

Manipulator

**Base Platform**
IOP V1.0 Compliant

**Engineers**

**Autonomous Mine Detection System** CDD,
Independent CARDS #06061, (9 JUL 09) (Payload)

PdM Counter Explosive Hazard,
(PEO Ammo)

**EOD Payloads (for MK2) EOD**

Single-Shot
Disrupter

Firing Circuit

CBRN Sensors for Application on Unmanned
Systems ICD, 23 FEB 06, CARDS #028-06
(Payload)

CBRN Sensors


**CBRN Payloads ( Chemical Units)**
JPM Nuclear Biological Chemical
(PEO Joint Bio Chem Defense)

**Robotic Deployment System**
PM Assured Mobility Systems

**MTRS Inc II RFP release targeted for 2nd QTR 2016**

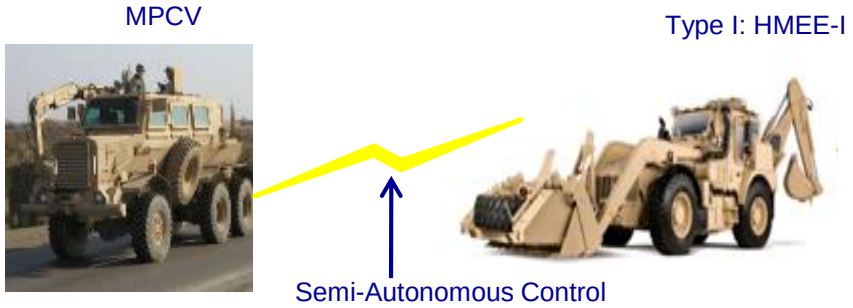
# Route Clearance & Interrogation System Capability Overview

- Route Clearance & Interrogation System (RCIS) CPD consists of two capabilities that are unmanned, semi-autonomously controlled, highly mobile platforms to support Route Clearance Platoons and the BCTs.

- RCIS Type I:
  - Optionally manned or unmanned
  - High Mobility Engineering Excavator (HMEE) capable of enabling Soldiers to semi-autonomously interrogate, excavate, and classify deep buried explosive hazards, IEDs, and caches.

- RCIS Type II to follow, leveraging technology and architecture from the RCIS Type 1 program

**RCIS TYPE 1**




**RCIS TYPE 2 (Future Effort)**

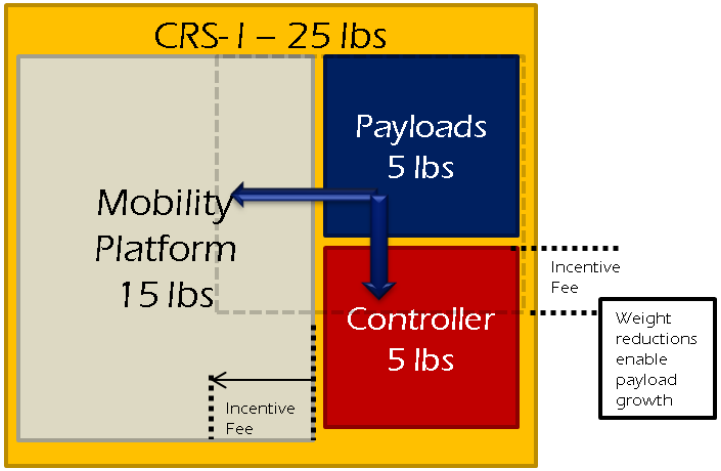

**RCIS Type 1 RFP release targeted for 3rd QTR 2016**

# Common Robotic System – Individual (CRS-I)

**System Description**: A man-packable (< 25lbs), miniature, highly mobile, unmanned robotic system with advanced sensors and mission modules for dismounted forces. Designed so that operators can quickly reconfigure for various missions by adding/removing modules and/or payloads. CRS-I will include a Common Controller.

**Addresses the Following Operational Capabilities Gaps:**

- Standoff short range Intelligence, Surveillance, & Reconnaissance (ISR)
- Remote Chemical, Biological, Radiological, and Nuclear (CBRN) detection
- Explosive Obstacle Counter Measure (EOCM)
- Explosive Ordnance Disposal (EOD)
- Future Users: Engineer, CBRN, INF, EOD




**Army Common Robotic System – Individual (CRS-I) with a Common Controller**

**25 lbs system weight**

Additional UGV

**Notional robot & controller diagrams*

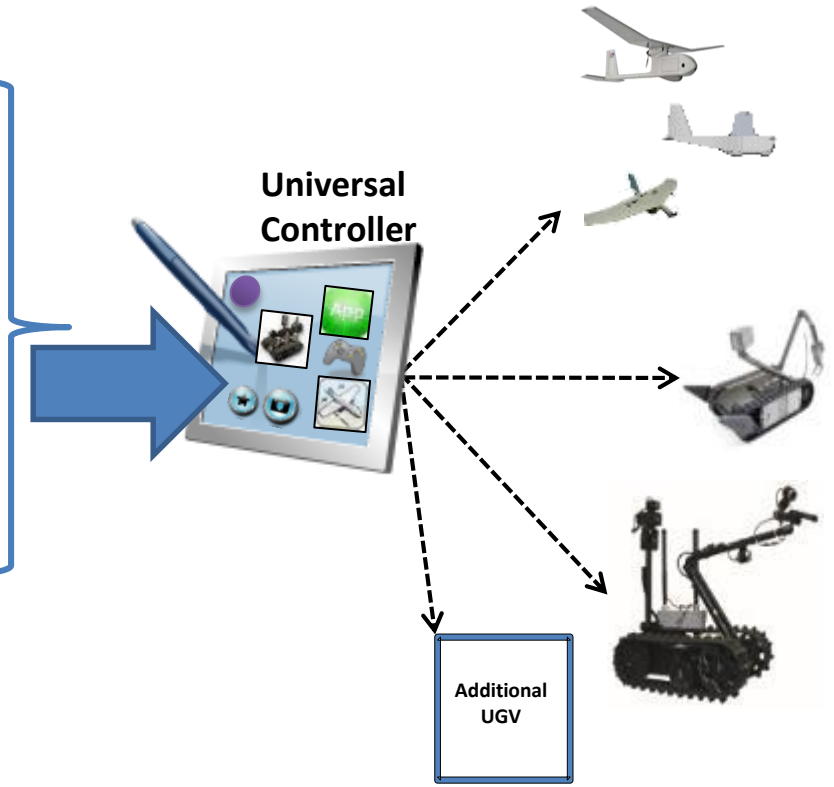
**RFP release targeted for 1st QTR 2017**

# Universal Controller Challenges to Industry

- How do we support different radios?
- How do we support different control standards?
- How do we minimize controller weight?
- How do we optimize between optimal control of each system & user interface commonality?

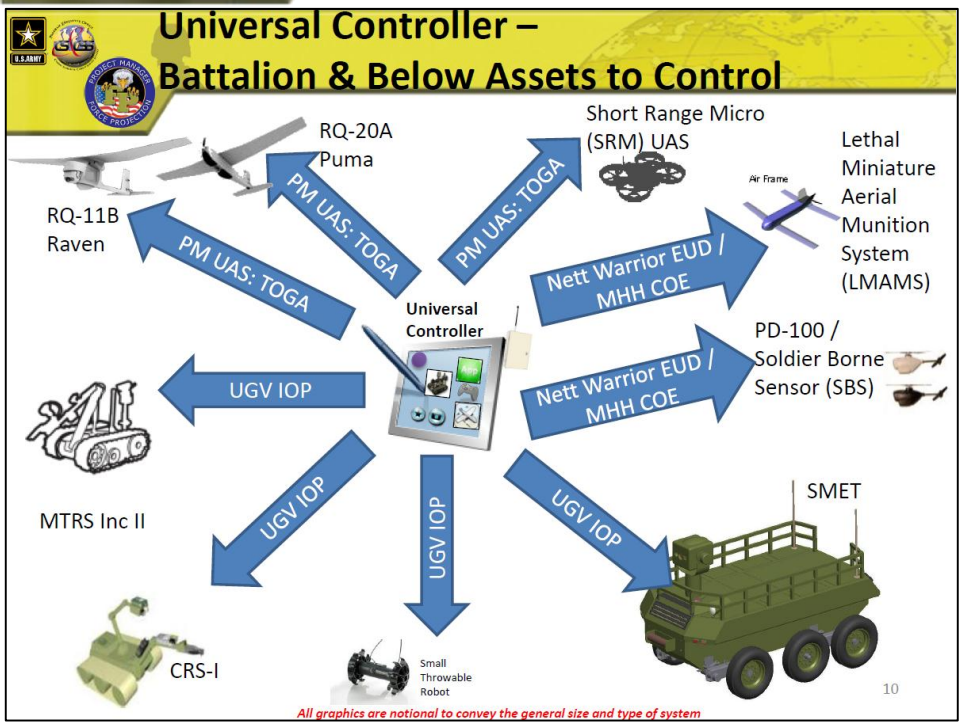
# Universal Controller Strategy

- Vision: controller(s) optimized in terms of the following characteristics:
  - Weight
  - Open Architecture
  - Ergonomics
  - Extensibility & Commonality
  - Cybersecurity
  - Application Based
  - Supportability & Maintainability




Need industry's help in making this a reality

# Universal Controller – Initial Concepts




Acronyms:
COE: Common Operating Environment
CRS-I: Common Robotic System, Individual
EUD: End User Device
LMAMS: Lethal Miniature Aerial Munition System
M/HH: Mobile/Hand-Held
MOCU: Modular Operator Control Unit
MTRS: Man Transportable Robotic System
OSD: Office of the Secretary of Defense
SBS: Soldier Borne Sensor
SPAWAR: Naval Space Warfare Center
TOGA: Tactical Open Government-owned Architecture
UCS: Unmanned Air System (UAS) Control Segment
UGV IOP: Unmanned Ground Vehicle Interoperability Profile

Soldier Systems

LMAMS
Soldier Borne Sensor (SBS) – PD-100

Air Systems

Short Range Micro (SRM) UAS
Puma
Raven RQ-11B

Nett Warrior EUD M/HH COE

UAS TOGA

SPAWAR MOCU

OSD UAS Control Segment (UCS)

UGV IOP

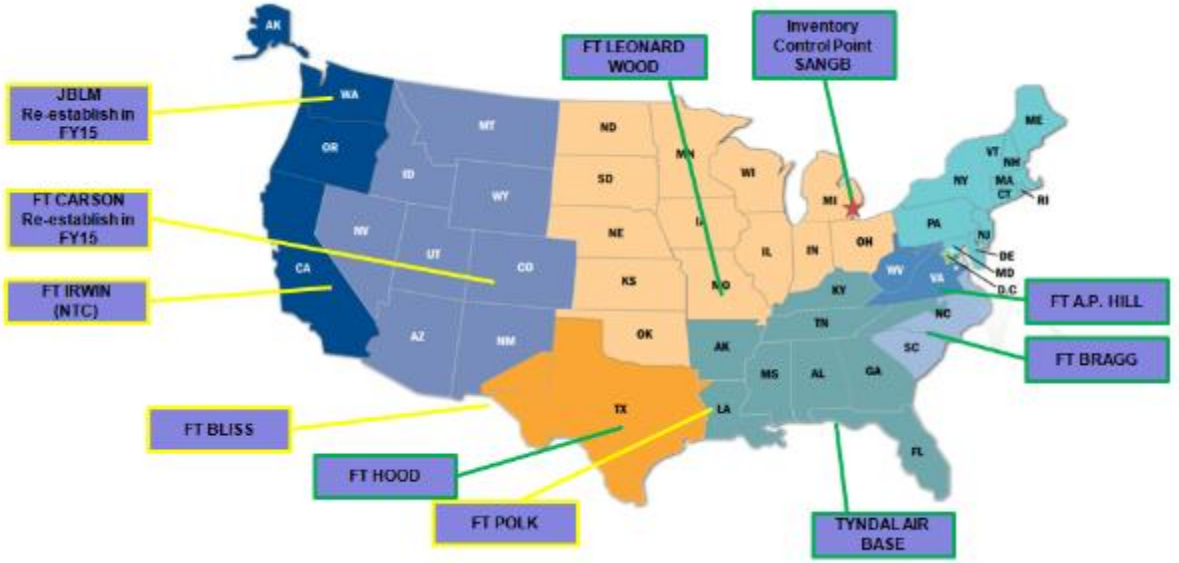
CRS-I
MTRS Inc II
Small Throwable Robot
SMET

Ground Systems

Is this the answer?

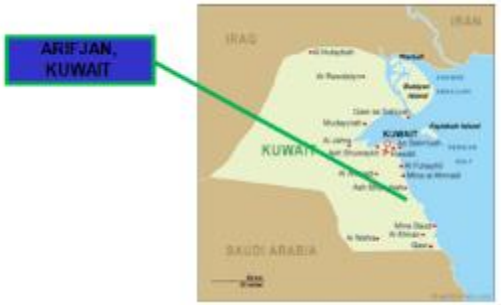
# RLSC Directed Requirement Portfolio

| Director Robotic Logistics Support Center | |
|---|---|
| Non Standard Robots | O&S |
| Man Transportable Robotic System (MTRS) MKII | O&S |
| Man Transportable Robotic System (MTRS) MKII Recap | O&S |




## Non-Standard Robots

| Talon IIIB | Talon IV | PacBot 510 FASTAC | SUGV 310 Mini-EOD | Dragon Runner | First Look |
|---|---|---|---|---|---|
|  |  |  |  |  |  |



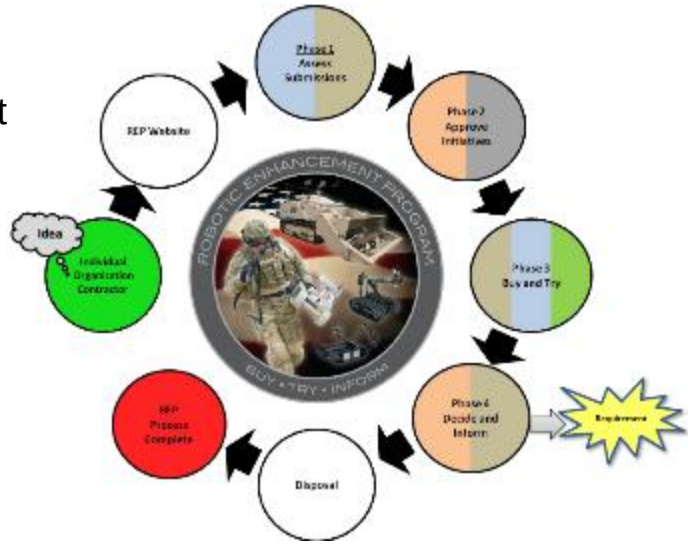

## MTRS EOD Robots

| MKII MOD0 | MKII MOD1 | MKII MOD2 | MKI MOD0 | MKI MOD1 | MK5 |
|---|---|---|---|---|---|
|  |  |  |  |  |  |

# Robotic Enhancement Program (REP)

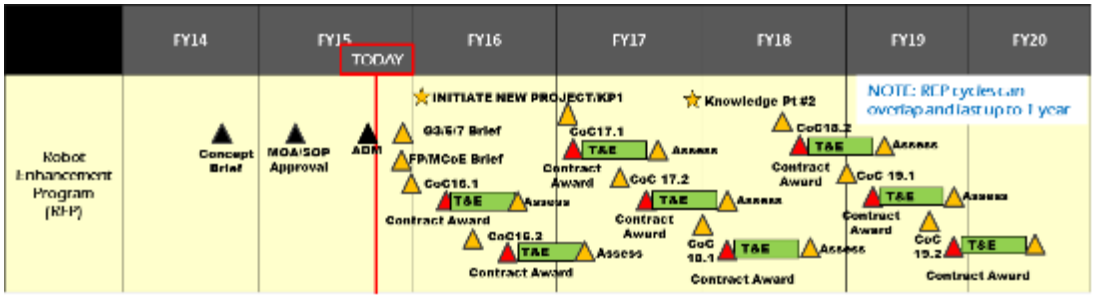
**Problem:** Robotic technology is rapidly evolving. The standard requirements/acquisition timeline of 3 to 7 years increases the risk that robotic systems will be obsolete before it is fielded or more likely, before it even reaches Initial Operational Capability (IOC).

**Mitigation:** Evaluate small quantities of state-of-the-art robotic systems and/or payloads to inform the requirement and acquisition process.




**Concept:**
- Concept based off of Solider Enhancement Program
- REP is a special project (not a full life cycle acquisition program)
- Uses a "buy-try-inform" methodology to better inform future Army requirements

**Experiment Focus:**
- Protect the Force
- Reduce Warfighter's Workload
- Enable Situational Awareness
- Sustain the Force
- Enable lethal and Non-lethal Engagements
- Reduce Cost




http://www.peocscss.army.mil/rep.html

# Emerging Requirements

# Squad-Multipurpose Equipment Transport (S-MET)

## Operational Concept

The S-MET should be capable of operating in three control regimes; tele-operation, semi-autonomous and autonomous. Semi- autonomous navigation will include wireless leader/ follower and waypoint navigation. The speed of the S-MET will allow for the squad to maintain its momentum during all operations.

| | SMET | L | M | S |
|---|---|---|---|---|
| Capacity | | 1000 lbs. | 600 lbs. | 300 lbs. |
| Range | On-road | 250 km | 100 km | 50km |
| | Xcountry | 125 km | 60 km | 30 km |


## Mission

The S-MET will lighten Warfighter's load and sustain the force during ops. The S-MET will maneuver with the dismounted force and enable Warfighters to conduct continuous ops without the individual Warfighter carrying equipment required to conduct 96 hours of dismounted operations.

# PLS A1 Leader Follower - Overview

**By Wire and Active Safety**

**Required Upgrades (By Wire)**
- Steering
- Braking
- Dashboard
- Data Buses (I/O)

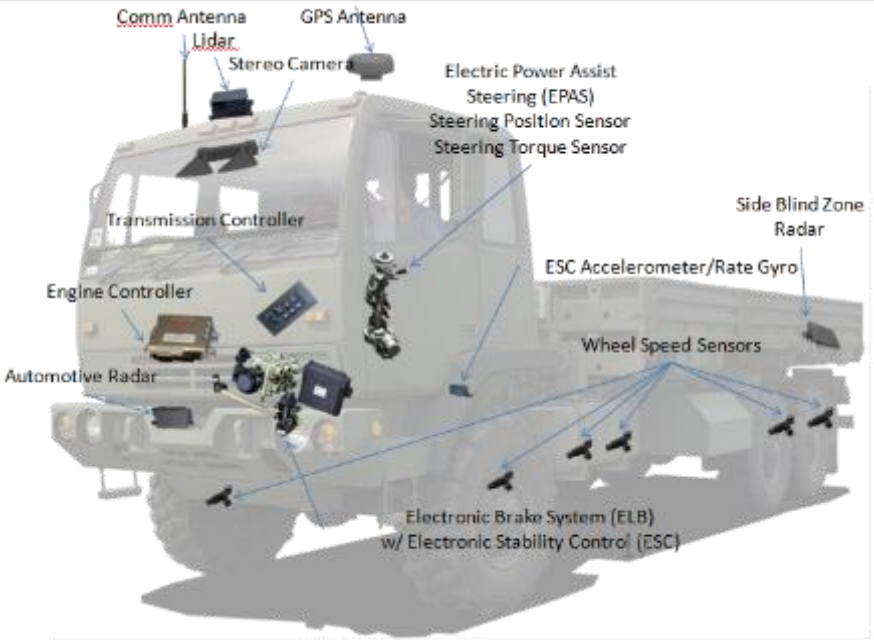
**Required Upgrades (Active Safety)**
- In-cab Camera (Bridge to ACO)
- Temperature Sensor
- Rain Sensor
- GPS and base maps (Bridge to ACO)
- DSRC (Bridge to ACO)
- Rear and Side Radars
- Wheel Encoders
- Forward Radar
- Display

**Leader Follower Robotic Capability**

**Required Upgrades (LF/Robotic)**
- LIDAR
- Tactical Radio
- Navigation Solution
- Cameras
- UWB Radios
- Fiducial Markers
- Computers

Provides Leader Follower Unmanned Capability to the PLS A1 Vehicle

# Automated Convoy Operations




## Appliqué Kit

A-Kit
Universal Brain

B-Kit
Vehicle Specific Connectors

C-Kit
Modular Sensors

Provides *optional* unmanned capability to *any* manned vehicle;
from driver assist to automated driving and navigation

# POCs

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UGV IOP

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# Discussion Requirements

# Universal Controller – Battalion & Below Assets to Control

RQ-20A Puma

PM UAS: TOGA

Short Range Micro (SRM) UAS

PM UAS: TOGA

RQ-11B Raven

PM UAS: TOGA


Lethal Miniature Aerial Munition System (LMAMS)

Nett Warrior EUD / MHH COE

**Universal Controller**

Nett Warrior EUD / MHH COE

PD-100 / Soldier Borne Sensor (SBS)

UGV IOP

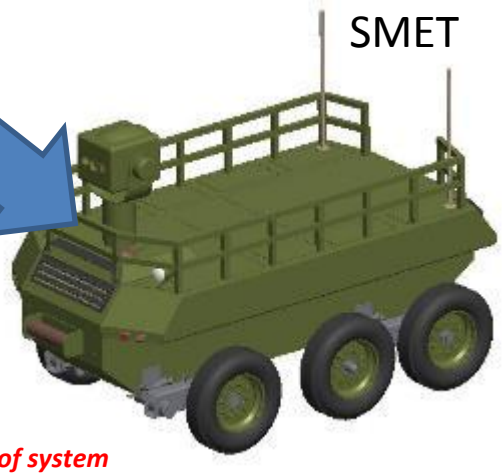
MTRS Inc II

UGV IOP

UGV IOP

UGV IOP

SMET



CRS-I

Small Throwable Robot

*All graphics are notional to convey the general size and type of system*