Warrior Tactical Robot
Training Needs Analysis Report

L-3/DPA Point of Contact:
Suzanne Royer
Senior Instructional Designer
L-3 Com / D.P. Associates
Office: 800-123-4567
Email: Address Redacted

Submitted to:
SME Name Redacted
Subject Matter Expert
iRobot Corporation
Phone: 888-123-4567
Email: Address Redacted

Presented by:

L3 communications
D.P. Associates Inc.

Table of Contents

DISCLAIMER

All proprietary information has been removed from the original document, and a new document was created from an empty template. Using features in Microsoft Word, Adobe PDF, or any other software application will not reveal any previous versions of the new document, nor any markup or comments in the new document – as none exist.

BACKGROUND

iRobot

iRobot is a company that designs behavior-based, artificially intelligent robots capable of tasks from cleaning floors to disarming explosives. Formed in 1990 by roboticists out of the Massachusetts Institute of Technology, iRobot is committed to creating robots that are used every day, and aims to help people complete tasks with better results. By striving to make highly reliable, easy to use, and affordable products, iRobot now creates robots for military and civilian customers around the world.

Warrior Robotic System

Seeing the need for adaptable yet durable robots capable of performing dangerous missions, iRobot has developed the Warrior, a remotely-operated robotic vehicle that goes where people cannot, should not, or do not want to go.

Warrior qualities are in abundance, and include adaptability, reliability, durability, precision, and ease of use. The Warrior is adaptable in that it can, for example, climb 45-degree angle stairs at 3 meters high, traverse a 2-foot gap, and cross 0.2 meters of water. The Warrior is reliable. It can successfully complete a four-hour Explosive Ordnance Disposal (EOD) mission operating at 1,600 watts per hour. This robot is also durable. It only needs an average of one hour of service for every 100 hours of use. Additionally, it can survive a 1.2-meter flat drop and operate at temperatures between -32 and 60 degrees Celsius. The Warrior is precise. It can, for example, perform a 180-degree turn in an area of 1.1 meters by 1.1 meters. Furthermore, the Warrior is easy to use. Its batteries can be changed without tools in less than five minutes.

These features allow the Warrior to perform tasks such as explosive ordnance disposal, surveillance and reconnaissance, minefield and obstacle reduction, toxic industrial chemicals/materials cleanup, and more – all without exposing operators directly to the hazards.

Training Requirements Analysis

Effective and efficient use of the Warrior will require skilled and knowledgeable operators. Recognizing the need for training, iRobot has requested that D.P. Associates (DPA) begin the instructional systems design (ISD) process by conducting an analysis of the training requirements and the target audience.

This report presents the methodology used to conduct training requirements analysis; the findings resulting from the process; and the recommendations for a training approach and syllabus that will yield the core competencies required to successfully operate and maintain the Warrior robotic system.

METHODS

Instructional Design Process

The process of instructional design involves the analysis of learning needs and systematic development of learning materials. The iRobot Warrior training recommendations in this report result from the application of the ADDIE instructional systems design process. Its five phases—Analysis, Design, Development, Implementation, and Evaluation—provide a systematic framework for identifying and satisfying training requirements.

Analysis Methodology

Data Types

Following this proven instructional design process, DPA analyzed operator and maintainer roles and responsibilities, target audience characteristics, product specifications, and context of use (including environmental factors and considerations).

Data Gathering Methods

Methods used to gather and analyze data included documentation review, domain research, subject matter expert interviews, and training audience research and inquiries. Documentation review entailed studying manufacturer manuals, iRobot publications, mission documentation, and accounts of lessons learned.

Figure 1. Analysis Process

Analysis Process

The analysis process is illustrated in Figure 1 and Figure 2. From data gathered, DPA analysts were able to extrapolate operator and maintainer tasks and characterize learner makeup. From DPA's mission tasks list, individual tasks were categorized as either trainable within the current training scope or tactical tasks to be trained by government personnel after the completion of iRobot factory training. Tasks deemed as trainable by DPA were then used to create a job tasks list and a list of learning objectives.

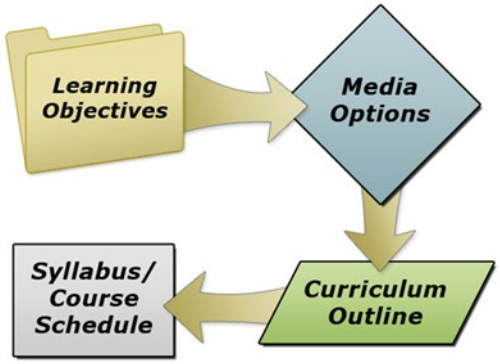

Figure 2. Analysis Process Continued

Learning objectives determined the media selection, and together they were used as input toward establishing a recommended training approach, which includes a suggested curriculum outline and syllabus.

The job task list and the list of learning objectives are under separate cover. The current list of learning objectives derived from the analysis phase is intended to be a preliminary, master list containing major goals and target objectives. Following training analysis, this preliminary list will undergo refinement during the next phase of the ADDIE instructional design process. Refinement entails confirming that each learning objective is a measurable, performance-based statement containing a behavior, a condition, and a standard. Doing so ensures that:

- Training content is designed to target specific learning outcomes in terms of required knowledge, skills, and abilities
- Criteria for measuring student mastery and evaluating training effectiveness is defined

FINDINGS

Overview

This section outlines major findings from DPA's training needs analysis. It covers the target audience, context of use, and the types of knowledge, skills, and abilities required to successfully operate and maintain the Warrior.

Target Audience

The Warrior was designed for use by military and civilian customers around the world. Its primary target audience is the U.S. army, while its secondary audience includes law enforcement, hazmat emergency response teams, engineers, and scientists. Given the target audience identified, trainee differences range in:

- Educational and professional backgrounds
- Prior exposure to a robotic system
- Knowledge, skills, and abilities related to robotic systems

Context of Use

Given its features, functionality, and capabilities, the Warrior is intended for manpower-intensive and high-risk functions, such as:

- Explosive ordnance disposal (EOD)
- Urban intelligence, surveillance, and reconnaissance (ISR) missions
- Minefield and obstacle reduction
- Toxic industrial chemicals and materials disposal

The environment in which the robot will be used varies in terms of terrain, obstacles, visibility, and temperature. To ensure operator safety, the Warrior will be controlled from a remote location, typically with the robot out of view.

Training Requirements

Considering the Warrior is a newly released product, initial training is required in order to successfully operate and maintain this remotely-operated robotic vehicle. With this in mind, DPA sought to identify the knowledge, skills, and abilities required to yield competency.

Warrior training requirements were derived directly from operator and maintainer tasks and their related learning objectives. Required knowledge, skills, and abilities were sorted according to learning level. After thorough analysis, DPA has determined the fundamental training requirements include:

- Knowledge of foundational concepts of Warrior robotic system
- Skills in Warrior operation and maintenance
- Ability to employ the Warrior to complete mission tasks

A detailed explanation of these fundamental training requirements is included below.

Mastery of Foundational Knowledge

Prior to attaining the skills and abilities necessary for task completion, trainees must possess a strong grasp of the following foundational concepts:

- Warrior purpose and mission types
- Robot capabilities and limitations
- System components, architecture, and functionality
- Standard operating procedures
- Field maintenance protocols and processes
- Safety guidelines

Critical to operating the Warrior is an understanding of its capabilities and limitations. A lack of understanding of the its capabilities can mean the operator does not leverage the robot to its full potential. Not understanding the robot's limitations can result in damage to the vehicle and its payloads as well as injury to its operator and bystanders.

Trainees need to understand the Warrior's capabilities and limitations to the extent they can effectively employ the robot in a mission setting. By learning the robot's capabilities and limitations, students will be prepared to decide how to best employ the robot for a specific mission.

Skill Proficiency in Robot Operation and Maintenance

Trainees must be able to unpack and set up the Warrior, maneuver the robot, operate the payloads, and complete tasks while best utilizing the capabilities of the robot for each of the primary mission areas.

The preliminary, master list of learning objectives focuses on the following major categories:

- Setup
- Robot operation
- Payload operation
- System/sensor interpretation
- Robot recovery
- Field maintenance
- Transport

Knowledge, skills, and abilities from these categories must be mastered in order to safely and effectively operate the Warrior.

Ability to Employ Robot to Complete Mission Tasks

Becoming a proficient robot operator requires the ability to safely and effectively employ the Warrior during the execution of a mission. Given that missions requiring a robot are often high-risk, mastery of critical robot operational knowledge, skills and abilities is paramount. These core competencies include, but are not limited to:

- Coordination and precision in maneuvering the robot and its payloads
- Accurate interpretation of system feedback to guide robot/payload movement and inform decision making
- Spatial orientation and situational awareness of the remote robot via software display
- Technical savvy in operating the software (laptop) and hand controller
- Optimization of the Warrior's features and functionality

Trainees must be able to synthesize all critical robot operational knowledge, skills, and abilities in the pursuit of mission achievement.

Summary of Major Findings

Major findings from DPA's training needs analysis are highlighted below.

- ***Reason for Training:*** Newly-released product
- ***Type of Training Required:*** Initial training
- ***Training Goal:*** Engender competent operators of the Warrior robotic system
- ***Fundamental Training Requirements:***
  - Mastery of foundational concepts of the Warrior robotic system
  - Skill proficiency in Warrior operations and maintenance
  - Ability to employ the Warrior to complete mission tasks
- ***Target Audience:***
  - Primary Audience: U.S. military
  - Secondary Audience: Law enforcement, hazmat emergency response teams, engineers, and scientists
  - Extended Audience: Military and civilian customers around the world
- ***Context of Use:***
  - Explosive ordnance disposal
  - Urban intelligence, surveillance, and reconnaissance missions
  - Minefield and obstacle reduction
  - Toxic industrial chemicals and materials disposal

RECOMMENDATIONS

Recommended Training Approach

Phased, Blended Learning Approach

Based on findings derived from a thorough training requirements analysis, DPA has determined a blended learning approach is the most advantageous option for yielding the core competencies identified. The recommended approach would leverage two training modalities and be administered in three phases.

	Major Topics	Training Approach
Phase 1: Foundational Knowledge Acquisition	▪ Purpose and mission types ▪ Robot capabilities and limitations ▪ Control location and function ▪ Operation and maintenance	e-Learning
Phase 2: Operational Skill Development	▪ Remote operation of the Warrior ▪ System setup ▪ Robot and payload operation ▪ Shutdown, transport, and storage ▪ Maintenance	Instructor-Led Training ▪ Guided, hands-on practice ▪ Instructor as coach ▪ Immediate, corrective feedback
Phase 3: Robot Employment Ability	▪ Basic and advanced driving maneuvers ▪ Negotiating various terrain types ▪ Surmounting obstacles ▪ Manipulating objects ▪ Precision in remote operation	Instructor-Led Training ▪ Scenario-based, hands-on, small-group exercises ▪ Instructor supervision ▪ Guidance as necessary

Table 1. Three-Phase Approach to Warrior Training

Flipped Classroom Model

The Flipped Classroom Model is a highly successful method for effectively sequencing the delivery of training content to facilitate the progression of knowledge, skills, and abilities. Following this model helps to ensure basic concepts are taught before complex concepts and lower-order skills are taught before higher-order skills.

DPA suggests integrating the Flipped Classroom Model into the recommended blended learning approach. In Phase 1, training would be delivered via e-learning. Students would gain exposure to new material and focus on lower levels of cognitive work—such as gaining knowledge and comprehension of foundational concepts—prior to attending class. Subsequently, in Phases 2-3, training would be administered via in-person, instructor-led classes. Class time would be used to learn new skills and apply them through hands-on interaction with the robot.

Phase 1: Underlying Knowledge Acquisition

Overview

Developing general knowledge of the Warrior in Phase 1 is necessary for students to be able to safely and effectively operate the robot. By building a foundation of information about the parts, functions, and features of the Warrior and associated payloads, students will acquire knowledge of fundamental concepts of Warrior operation and sensor capabilities.

e-Learning

Given the nature of these training requirements, e-learning will be utilized in Phase 1 to yield student knowledge, comprehension, and retention of foundational concepts of Warrior robotic system.

This phase will provide students with a consistent foundation of knowledge upon which higher-order cognitive skills and psychomotor skills will be built during the subsequent phase of training.

Phase 1 training, for example, will establish the cognitive relationship between sensor displays, Warrior configuration, and Warrior and payload positioning. The more the students understand about the design, functions, capabilities, and limitations of the robot, the more effectively they will be able to operate the system functions during subsequent training phases.

In addition, with an effective mental model of the control system during e-learning, trainees can achieve skilled task performance more quickly when they progress to the next training phase.

Furthermore, with the effective use of graphics and three-dimensional animated representations of Warrior and payload movements during e-learning, students will be able to rapidly understand the relationship between their control input, the Warrior's response, and the resulting change in the sensor displays.

Performance Support Tools

Performance support tools made available during e-learning would include quick reference guides, job aids, and microlearning videos. Microlearning videos would contain expert demonstrations of operational and maintenance procedures.

e-Learning as a Prerequisite

Considering the focus on Phase 1 is foundational knowledge, successful completion of Warrior e-learning courses would be required prior to attending instructor-led training (in Phase 2). Given the differences in trainee backgrounds and experience levels with robotic systems, enforcing this prerequisite would ensure all individuals begin in-person classes with the same foundational knowledge of the robotic system.

Phase 1 Composition: e-Learning Courseware

The e-learning portion of training would be comprised of two courses: operations and maintenance. The estimated time for completion of both courses is approximately seven hours. The suggested e-learning curriculum structure is included below.

Operations Course

The operations course would include six hours of self-paced training content, spanning four modules.

MODULE 1: INTRODUCTION
- Lesson 1: Warrior Capabilities
- Lesson 2: Warrior Tactical Robotic System

MODULE 2: GETTING STARTED
- Lesson 1: System Setup
- Lesson 2: Login and Session Launch
- Lesson 3: Understanding Key Concepts

MODULE 3: BASIC OPERATIONS
- Lesson 1: Basic Driving Skills
- Lesson 2: Basic Observation Skills
- Lesson 3: Basic Manipulation Skills
- Lesson 4: Recovery and Shutdown
- Lesson 5: Storage and Transport

MODULE 4: ADVANCED OPERATIONS
- Lesson 1: Advanced Driving Skills
- Lesson 2: Advanced Observation Skills
- Lesson 3: Advanced Manipulation Skills
- Lesson 4: Additional Payloads and Sensors

Maintenance Course

This one-hour, standalone course covers field maintenance procedures that do not require troubleshooting or extensive and involved repair. Course content includes steps for replacing the batteries, hand controller, flippers, chassis tracks, payload bay connector covers, and GPS antenna. Procedures for preventative maintenance checks and cleaning are also included in the course.

Phase 2: Operational Skill Development

Overview

Having established the framework of knowledge in Phase 1 of training, Phase 2 will target the psychomotor skills required to control the Warrior and its payload. Research and experience over the years has shown that the single most effective training approach for skills of this nature is to maximize the opportunity for practice with feedback.

Higher-order thinking skills will also be addressed in Phase 2, as students assimilate new concepts they acquire in class through synthesis, application, problem-solving, and discussion - with the support of their peers and the instructor.

Instructor-Led Training with Guided Practice

To deliver the best results given the nature of these skills, instructor-led training will be utilized in Phase 2. To facilitate the development of these skills, instructional strategies such as activity-based learning and social learning will be leveraged.

Instructional Methods

Instructional methods used in class would include:

- Lectures
- Demonstrations
- Guided, hands-on practice
- Class discussions
- Question-and-Answer sessions

Lectures

No lengthy lectures. Time spent on lectures will be brief, as their purpose is to:

- Review and reiterate key concepts (covered earlier via e-learning)
- Share expert tips and insights
- Segue to instructor skill demonstrations

Demonstrations

During instructor demonstrations, students benefit from a close-up view of an expert showing them the ideal way to complete a particular task. Students come away the model behavior with which to emulate during guided, hands-on practice.

Guided, Hands-on Practice

Guided practice will be utilized as a form of training as students learn by doing. Serving as a coach, the instructor observes and guides students as they apply concepts and engage in initial, first-hand interaction with the robot. The instructor provides immediate, constructive feedback, and an expert-apprentice relationship ensues.

Guided practice will focus on individual skill areas, following the corresponding instructor demonstration. These skill areas include:

- Setup
- Basic driving skills
- Basic observation skills
- Basic manipulation skills
- Field maintenance
- Advanced driving skills
- Advanced observation skills
- Advanced manipulation skills

Class Discussions and Question-and-Answer Sessions

Social learning is an excellent strategy for engaging students. Requiring student participation in class discussions and question-and-answer sessions is one way to incorporate social learning into the classroom, and do so has numerous benefits.

- Deeper processing naturally occurs when students actively discuss and vocalize their understanding of concepts.
- Students' questions and comments will bring to light any lingering areas of confusion and common misconceptions.
- Instructor responses will provide clarification and correction, as needed.
- Insights gained from student participation can be used to improve training content.
- Open-ended questions—aimed at encouraging students to talk about their experiences interacting with the robot—would prompt individuals to reflect on their performance and contemplate the lessons learned.

Performance Support Tools

During instructor-led training, performance support tools—such as student guides, quick reference guides, and job aids—would be distributed.

Phase 2 Composition: Instructor-Led Training with Guided, Hands-on Practice

With a focus on guided, hands-on practice, Phase 2 will take place on days one through three of the instructor-led training course. A high-level course structure with major topic areas is included below.

BASIC OPERATIONAL SKILLS

- Course Overview
- Warrior Tactical Robotic System Overview
- Initial Setup
- Initial Setup Practical Exercise
- Basic Driving
- Basic Driving Practical Exercises
- Basic Observation
- Basic Observation Practical Exercises
- Basic Driving and Observation
- Basic Driving and Observation Practical Exercises
- Basic Manipulation
- Basic Manipulation Practical Exercises
- Audio and Accessories
- Robot Recovery and System Shutdown
- System Storage and Transport

ADVANCED OPERATIONAL SKILLS

- Advanced Driving
- Advanced Driving Practical Exercises
- Advanced Observation
- Advanced Observation Practical Exercises
- Advanced Manipulation
- Advanced Manipulation Practical Exercises

MAINTENANCE SKILLS

- Field Maintenance
- Field Maintenance Practical Exercises

Phase 3: Robot Employment Ability

Hands-on, Scenario-Based, Group Exercises

Phase 3 training targets problem-solving skills associated with making use of the Warrior in a mission setting. Given specific scenarios, trainees will employ the robot during the execution of a simulated mission. In order to complete these scenario-based exercises, students must draw upon, synthesize, and apply critical robot operational knowledge, skills, and abilities.

Small-Group Collaboration for Social Learning

Students will work together in small groups, under instructor supervision with guidance provided when necessary. During collaboration, each trainee will consider the feasibility of peer suggestions on the best approach for accomplishing the mission with the aid of the Warrior. As a form of social learning, these collaborative exercises will—not only build skills in critical thinking, decision making, and problem solving—but will also facilitate deeper processing of acquired knowledge, skills, and abilities.

Application of Prior Feedback

Furthermore, these scenario-based, group exercises will provide additional hands-on practice as trainees apply what they have learned from instructor feedback during guided practice in Phase 2. Students will continue to further their skills in remote operation as well.

Performance Support Tools

Quick reference guides would be made available for use during these scenario-based exercises.

Phase 3 Composition: ILT with Robot Employment Scenario Exercises

With a focus on robot employment, Phase 3 will take place during the latter part of instructor-led training classes. More specifically, day four will be devoted to hands-on, scenario-based, group exercises. Major topic areas to be covered during this portion of training are outlined in Table 2.

Scenario 1 Areas of Focus	Scenario 2 Areas of Focus
▪ System setup ▪ Remote operation ▪ Main menu navigation ▪ Basic driving maneuvers ▪ Interpretation of system feedback to guide robot and payload movement ▪ Negotiating various types of terrain and obstacles	▪ Coordination and precision in robot and payload operation ▪ Ascending and descending stairs ▪ Grasping, lifting, carrying, and releasing objects ▪ Using the manipulator to look under a vehicle, over a wall, and around a corner inside a building

Table 2: Scenario Areas of Focus

Summary of Performance Support Tools – All Phases

All phases of training would include performance support tools. Based upon anticipated need, specific types of resources and tools were identified as applicable per phase and training modality

Phase 1	Phase 2	Phase 3
e-Learning	Instructor-Led Training	Instructor-Led Training
Self-Paced Courses	Guided, Hands-on Practice	Scenario-based, Hands-on, Group Exercises
▪ Quick reference guides ▪ Microlearning video ▪ Info graphics ▪ Job aids	▪ Student guides ▪ Quick reference guides ▪ Job aids	Quick reference guides

Table 3: Performance Support Tools – All Phases

Microlearning Videos

Microlearning videos will contain expert demonstrations of operational and maintenance procedures.

Quick Reference Guides

Quick reference guides would be included in all phases of training. These guides would cover, at a minimum, the following key concepts:

System Components
- Robotic Vehicle Components
- Operator Control Unit (OCU) Components

Power Sources
- Robotic Vehicle Power
- OCU Power

Software
- Hand Controller Button Mapping
- Menu Navigation
- Operational Modes

Recommended Syllabus

Through deliberate and purposeful sequencing, DPA has created a syllabus that provides the means by which the recommended training approach can be implemented. The syllabus employs two training methods and spans across three phases.

Utilizing this syllabus allows Warrior trainees to:

- Master underlying knowledge at their own pace
- Acquire basic operator skills through guided, hands-on practice
- Fine-tune operator skills by employing the Warrior during scenario-based, hands-on, group exercises

Table 4 presents a summary of the recommended training approach.

e-Learning	Instructor-Led Training	
Phase 1: Knowledge Acquisition	**Phase 2:** Operational Skill Development	**Phase 3:** Robot Employment Ability
Self-paced instruction focusing on foundational concepts	Guided, hands-on practical exercises focusing on building individual skills with regard to operating the Warrior and robotic system	Scenario-based, hands-on, group exercises focusing on fine-tuning operational skills as well as applying multiple skills simultaneously and in a coordinated manner

Table 4: Performance Support Tools

The resulting syllabus is shown on pages 19-23. The e-learning training syllabus (Figure 3) and the instructor-led training syllabus (Table 6) are shown separately.

Table 5, beginning on the next page, provides a consolidated view of the syllabus for the entire Warrior Tactical Robot curriculum. Its contents illustrate how each aspect of the training approach, when used together and sequenced strategically, can be leveraged to meet the training requirements.

	e-Learning	Instructor-Led Training			
	Phase 1: Knowledge Acquisition	**Phase 2:** Operational Skill Development		**Phase 3:** Robot Employment Ability	**Assessment**
Duration	7 HOURS	DAY 1	DAY 2 / DAY 3	DAY 4	DAY 5
Key Aspects	Self-paced, interactive, multimedia instruction	▪ Guided, hands-on practice with robot ▪ Immediate, corrective feedback ▪ Focus: building individual skills		▪ Scenario-based, hands-on, group exercises using robot ▪ Instructor supervision with guidance when necessary ▪ Focus: applying multiple skills	Skills proficiency demonstrations with no guidance from instructor
Training Requirements	Mastery of foundational Warrior concepts	Skill proficiency in robot operations and maintenance		Ability to safely and effectively employ the Warrior during scenario-based exercises containing representative mission tasks	Core Competencies ▪ Mastery of foundational Warrior concepts ▪ Skill proficiency in robot operations and maintenance ▪ Ability to effectively employ robot and payloads during mission execution
Targeted Training Goals	Lower-order cognitive skills	▪ Basic psychomotor skills required to control the Warrior and its payload ▪ Higher-order cognitive skills		▪ Synthesis of critical knowledge, skills, and abilities ▪ Refinement of psychomotor skills ▪ Critical thinking skills ▪ Decision making skills ▪ Problem solving skills	N/A

Table 5. Consolidated Syllabus for Entire Blended Learning Curriculum – Part 1

	e-Learning	Instructor-Led Training			
	Phase 1: Knowledge Acquisition	**Phase 2:** Operational Skill Development		**Phase 3:** Robot Employment Ability	**Assessment**
Duration	7 HOURS	DAY 1	DAY 2 / DAY 3	DAY 4	DAY 5
Content Covered	▪ Purpose of Warrior ▪ Robot capabilities and limitations ▪ System components, functions, and features ▪ Essentials of remote operation ▪ Functions of Operator Control Unit and main menu ▪ Operational and maintenance procedures ▪ Safety precautions	▪ Remote operation of Warrior ▪ Working knowledge of relationship between operator control input, Warrior response, and resulting changes in software display ▪ Use of operator control unit to guide robot and payload movement ▪ Driving, observation, and manipulation skills		▪ System setup ▪ Driving maneuvers ▪ Manipulation of objects ▪ Accurate interpretation of system feedback to guide robot and payload movement ▪ Coordination and precision in robot and payload operation ▪ Main menu navigation	▪ Negotiating various terrain types (gravel, mud, sand) ▪ Surmounting obstacles (slopes, curbs, logs, rocks, ditches) ▪ Ascending and descending stairs ▪ Grasping, lifting, carrying, and releasing objects
Instructional Models	▪ ADDIE and SAM ▪ Flipped Classroom Model ▪ Bloom's Taxonomy	▪ Flipped Classroom Model ▪ Learn by Doing ▪ Social Learning		▪ Learn by Doing ▪ Social Learning	Evaluation Model: Kirkpatrick
Instructional Methods	▪ Storytelling ▪ Scenario-based exercises ▪ Microlearning video ▪ Interactivity and games ▪ 3D Animations ▪ Instructional graphics	▪ Instructor demonstrations ▪ Guided, hands-on practice with robot, focusing on one skill at a time ▪ Expert feedback, tips, insights ▪ Lectures (brief review of key concepts) ▪ Class discussions ▪ Q&A Sessions		▪ Hands-on, scenario-based exercises ▪ Group collaboration ▪ Instructor supervision with guidance when necessary	Evaluation Method ▪ Student demonstrations ▪ Metrics per performance-based learning objectives

Table 5. Consolidated Syllabus for Entire Blended Learning Curriculum – Part 2

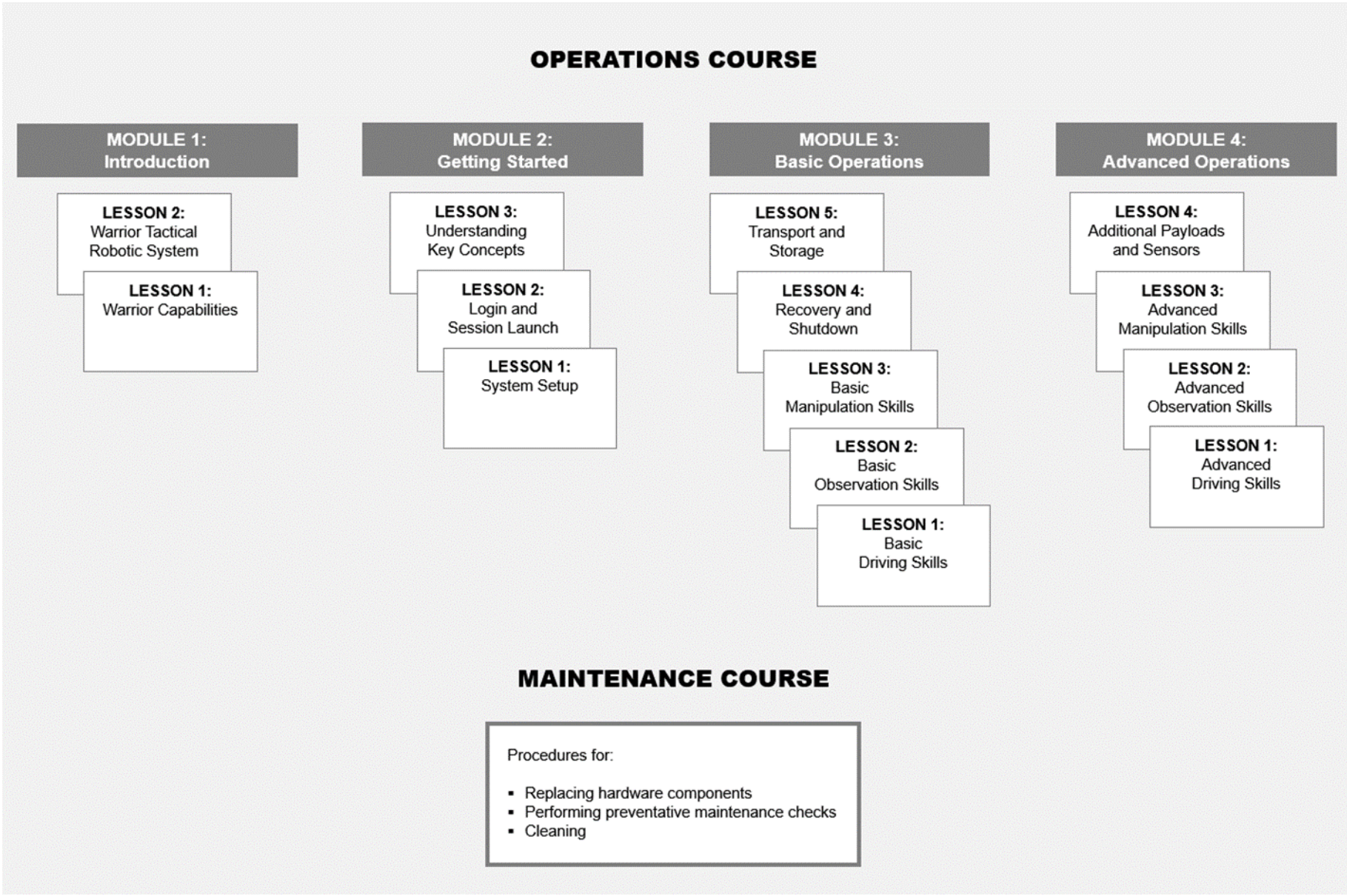

Figure 3. e-Learning Syllabus (Phase 1)

Instructor-Led Training					
	Phase 2: Operational Skill Development			Phase 3: Robot Employment	Assessment
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
8:00	Course Overview	Basic Driving and Observation	Advanced Driving	Robot Employment Scenario Overview	Skills Proficiency Demonstration Overview
	Warrior System Overview	Basic Driving and Observation Practical Exercises	Advanced Driving Practical Exercises	Employ Warrior System Scenario 1	Student Skills Proficiency Demonstration 1
9:00	Initial Setup				
	Initial Setup Practical Exercise				
10:00		Basic Manipulation			
		Basic Manipulation Practical Exercise	Advanced Observation		
11:00	Basic Driving		Advanced Observation (Low-Light) Practical Exercise		
12:00	Lunch				

Table 6. Instructor-Led Training Syllabus – Part 1 (Phases 2-3 and Assessment)

The instructor-led training syllabus is continued on the next page.

Instructor-Led Training					
	Phase 2: Operational Skill Development			Phase 3: Robot Employment	Assessment
	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
13:00	Basic Driving Practical Exercises	Audio and Accessories	Advanced Manipulation	Employ Warrior System Scenario 2	Student Skills Proficiency Student Demonstration 2
		Field Maintenance			
14:00	Basic Observation	Field Maintenance Practical Exercises	Advanced Manipulation Practical Exercises		
	Picture and Video Capture				
	Sensor Interpretation				
15:00	Basic Observation Practical Exercises				
16:00		System Storage and Transport			
	Recovery and Shutdown				
	Review and Questions	Review and Questions	Review and Questions	Review and Questions	Course Evaluation and Graduation
17:00	**Class Dismissed**				

Table 6. Instructor-Led Training Syllabus – Part 2 (Phases 2-3 and Assessment)

Benefits

Effective and efficient use of the Warrior will require skilled and knowledgeable operators. To this end, DPA has strategically designed a training approach and syllabus intended to methodically drive student mastery of core competencies identified in the training requirements. This multifaceted approach encompasses a blend of training modalities and incorporates sound, well established instructional models and methods.

Providing myriad benefits, the recommended training approach with corresponding syllabus:

- Sequences instruction in a way that provides a clear path for the progression of skills leading to the attainment of core competencies
- Includes only the training modalities best suited for producing successful learning outcomes, given the training requirements
- Leverages the strengths of each modality by incorporating specific instructional models, methods, and techniques particularly effective in each learning environment
- Enacts cost-cutting measures by using e-learning to introduce new concepts; thereby, laying the groundwork for hands-on training with a live instructor

In addition, adopting the Flipped Classroom Model has several advantages of its own. With e-learning as a prerequisite, trainees from diverse backgrounds and different levels of experience subsequently come to in-person classes possessing a consistent body of foundational knowledge. Not only does this benefit students by leveling the playing field, but it also allows the instructor to begin class from a common baseline. Then, to optimize face-to-face class time, activity-based methods and social learning techniques are implemented. These range from hands-on practice with the robot followed by expert feedback to collaborative, problem solving exercises to class discussions and question-and-answer sessions. All of these techniques promote increased engagement, deeper learning, and enhanced retention.

Moreover, content from initial training could be repurposed for future efforts, such as refresher training and certification training.

In summary, the overall training approach is designed to provide the following benefits:

- Cost-effective
- More comprehensive educational experience
- Improved effectiveness
- Enhanced retention and engagement
- Increased satisfaction
- Reusable content

The recommended training approach with corresponding syllabus provide a meticulously designed curriculum plan for delivering highly competent operators of the Warrior and its robotic system.