Defining Virtual Training System Requirements for Foreign Military Sales

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ABSTRACT

The United States (U.S.) Department of Defense (DoD) offers a "total package approach" to partner nations that purchase defense articles and services through the Foreign Military Sales (FMS) program. A total package approach includes training, maintenance, operations, and sustainment. While success of the total package approach relies on definition of robust requirements in a partner nation's Letter of Request (LOR), increased stakeholder participation during FMS case execution often results in realization of additional requirements. Unique requirements for a virtual training system may result from differences in concept of operation of the weapons platform, training objectives, and concept of operation and sustainment of the training system within a customer's regulatory environment. This paper aligns definition of a partner nation's unique virtual training system requirements to DoD guidance for building an LOR, and presents implications of implementing these requirements within cost, schedule, and U.S. regulatory constraints of an FMS case. In conclusion, the paper recommends that partner nations prudently define unique, robust requirements for an FMS virtual training system, that DoD exercise due diligence in evaluating partner nation requirements, and that industry partners maintain awareness of unique partner nation requirements for FMS virtual training systems.

ABOUT THE AUTHORS

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The views expressed herein do not necessarily reflect the official position of the organizations with which they are affiliated.

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INTRODUCTION

Armed forces worldwide have numerous options for procuring weapon systems. Generally speaking, partner nations seeking to purchase weapon systems from the United States (U.S.) may either utilize Department of Defense (DoD)-administered channels such as the Foreign Military Sales (FMS) program, or purchase directly from industry via Direct Commercial Sales (DCS). DoD advocates a "total package approach" in support of FMS cases to ensure a partner nation receives all articles, training, and support required to operate and sustain a system. While "training" may involve live training with the weapon system, classroom training, or use of DoD virtual training systems, a partner nation may seek to purchase its own virtual training system to establish an organic training capability. A partner nation may wish to tailor an FMS training system to support its concept of operations (CONOPS) for the weapon system, training objectives, and operating locations. In addition, a partner nation may develop its own set of standards for operation and sustainment of a training system due to its infrastructure and regulatory environment. Discussion of unique virtual training system requirements early in FMS case development allows DoD to offer a total package approach that will address a partner nation's unique training requirements.

This paper provides an overview of the FMS process and of life cycle support practices that DoD applies in the Defense Acquisition System. After describing characteristics of virtual training systems that drive technical and life cycle support requirements, the paper discusses the applicability of such requirements to a partner nation's Letter of Request (LOR) for an FMS case involving the sale of a virtual training system. The paper then discusses caveats within both DoD and the partner nation that may impede DoD's ability to deliver a system that meets these requirements. The paper concludes by providing recommendations to partner nations, DoD, and industry for defining and implementing unique FMS virtual training system requirements.

OVERVIEW OF THE FOREIGN MILITARY SALES PROGRAM

U.S. Legal and Regulatory Basis for Foreign Military Sales (FMS)

Coleman and Denny (2014) provides the following summary of the legal basis for FMS, and the interaction of the FMS process with the Defense Acquisition System:

> FMS programs are authorized by the [Arms Export Control Act,] AECA (as amended, 22 U.S.C. 2751 *et seq.*), which grants the President the authority to implement contracts for procurement and delivery of defense articles and services to international customers (22 U.S.C. Section 2762(a)). Executive Order 13637 (2013) delegates this authority: the Department of State (DoS) is responsible for supervision and direction of FMS programs, while DoD is responsible for management of FMS programs. The AECA requires that international customers must reimburse DoD for all FMS procurement costs, including any damages or cancellation costs (Section 2762).
>
> DoD Directive (DoDD) 5132.03 (Under Secretary of Defense for Policy (USD(P)), 2008) defines FMS programs as security assistance activities, a subset of DoD-managed security cooperation activities (p. 11). The Defense Security Cooperation Agency (DSCA) is a DoD agency chartered by DoDD 5105.65 (Director of Administration and Management (DA&M), 2012) and tasked with guiding DoD components with regard to security cooperation and security assistance activities (p. 1). DoDD 5105.65 authorizes and directs DSCA to publish DSCA 5105.38-M, the *Security Assistance Management Manual* (*SAMM*; http://www.samm.dsca.mil). The *SAMM* guides DoD components in development and execution of FMS and other security assistance programs. In

> addition, DoDD 5105.65 provides for the administration of the Defense Institute of Security Assistance Management (DISAM) [now known as Defense Institute for Security Cooperation Studies, DISCS], which educates the security cooperation workforce (p. 4) and publishes the *Management of Security Cooperation* manual (*Green Book*; Grafton, 2014), a textbook that summarizes DoD policies toward [cooperative programs] and FMS programs. (p. 3)

SAMM Section C6.3.1 directs DoD to execute FMS contracts with industry "in accordance with DoD regulations and other applicable USG procedures." DoDI 5000.02 (Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L), 2017), "Operation of the Defense Acquisition System," requires DoD "to consider international involvement throughout the acquisition life cycle (p. 84)." Figure 1, updated from Coleman and Denny (2014), illustrates the relationship among the acquisition life cycle for a DoD article, the FMS case development and execution process, and the resulting acquisition life cycle for development and delivery of the article to a partner nation.

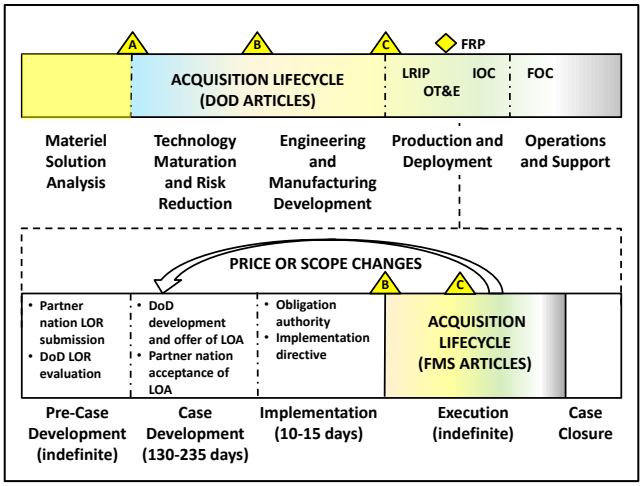

Figure 1 - Summary of the FMS Process in the Defense Acquisition System. Compiled from DoDI 5000.02, DISCS *Green Book* (Ch. 5). Updated from Coleman and Denny (2014), p. 3.

The Letter of Request (LOR)

SAMM Section C5.1.1 states that "[the FMS process] begins when an eligible foreign country or international organization requests information on defense articles or services, including training, being considered for purchase;" Section C5.1.2 defines these requests to be Letters of Request, or LORs. As described in Section C2.1.1.1, the U.S. assigns DoD personnel to a Security Cooperation Office (SCO) within a partner nation to manage security cooperation and security assistance functions, including FMS. Section C.2.1.4.1 indicates that "SCOs often have the opportunity to provide input to, or otherwise inform development of, partner nation LORs," and should coordinate within DoD to assist the partner nation in drafting an LOR. DSCA Policy Memo 18-09, issued in April 2018, updated *SAMM* Section C5.1.2.2 to direct DoD agencies to develop "system-specific checklists designed to help ensure that requirements are fully defined, to account not only for weapon systems but also for the logistics, construction, training and support services needed to deliver a complete and sustainable capability to the FMS customer."

As indicated by *SAMM* Section C5.2.1, the U.S. Government may respond to an LOR with an LOA or Pricing and Availability (P&A) data. Section C5.3.1 defines P&A data as being "rough order of magnitude estimates of cost and availability of defense articles or services … sufficiently accurate for rough-order planning purposes, but [not for use for] budget purposes and are not commitments."

The Letter of Offer and Acceptance (LOA)

SAMM Section C5.4.1 defines the LOA as "the legal instrument used by the [U.S. Government] to sell defense articles, defense services including training, and design and construction services to a foreign country or international organization under authorities provided in the Arms Export Control Act (AECA)." When implemented, the LOA is "an official tender by the [U.S. Government]" to a partner nation for sale of defense articles and services.

The Total Package Approach

SAMM Section C4.3.2 states that the total package approach requires DoD to offer "support articles and services, to include construction of necessary support facilities," to a partner nation as part of the purchase of a system via FMS. While Section C4.3.2 mentions "training" as part of a total package approach to an FMS purchase, a virtual training system itself may be the principal defense article in an FMS transaction. Hence, a DoD response to an LOR for a

training system, whether for P&A data or an LOA, must offer a complete set of articles and services to support operation and sustainment throughout the anticipated life cycle of the system.

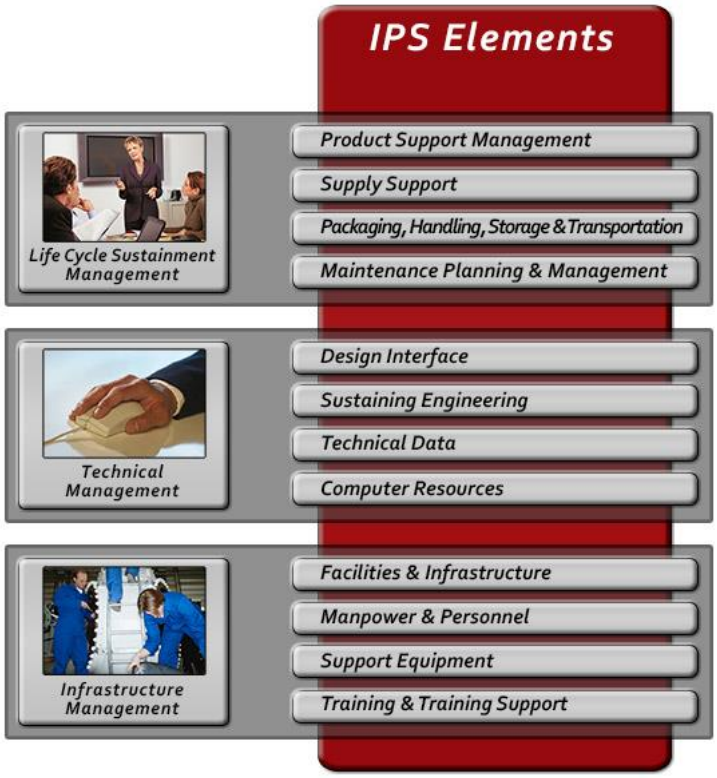

Figure 2 - The Twelve IPS Elements. Source: DAU (2018).

OVERVIEW OF LIFE CYCLE SUPPORT AND INTEGRATED PRODUCT SUPPORT ELEMENTS

The *Defense Acquisition Guidebook* (Defense Acquisition University (DAU), 2017) Section 4-2 defines life cycle sustainment as "the range of planning, implementation, and execution activities that support the sustainment of weapon systems" (p. 1). Section 4-2.1 states the goal of life cycle sustainment planning is "to maximize readiness by delivering the best possible product support outcomes at the lowest Operating and Support (O&S) cost." Section 4-2.2 defines a product support strategy as "the integration of the requirements, a product support package, and resources." The product support package is "the detailed implementation approach for the product support strategy" (p. 2).

Section 4.2-2 further defines twelve Integrated Product Support (IPS) elements as "the backbone of the product support package." Figure 2, taken from the DAU Life Cycle Logistics Community website, shows the twelve IPS elements residing in three overarching logistics management areas.

A virtual training system may inherit hardware, software, and technical data from a live platform, but may utilize unique hardware, software, and technical data in order to replicate or simulate the platform and its behavior in a synthetic environment. Partner nations should be aware of differences in hardware, software and technical data between a live platform and a virtual training system in order to prioritize unique technical and life cycle support requirements for a virtual training system.

PARTNER NATION CONSIDERATIONS FOR VIRTUAL TRAINING SYSTEMS

Technical Requirements

A virtual training system may contain hardware, software and technical data common to the weapons platform. While specialized hardware differentiates military vehicles from civilian counterparts, virtual training systems are increasingly based on commercial, off-the-shelf (COTS) hardware sold to private-sector markets such as civil aviation, cinema, and personal computing. A military virtual training system may stimulate specialized hardware common to the weapons platform, but often specialized software and technical data residing on COTS hardware provide the capability to train students to operate the live platform within a synthetic environment. Hence, partner nations desiring to train CONOPS or training objectives unique to its armed forces may have to provide technical data or fund modifications to software used within a virtual training system.

Life Cycle Support and Integrated Product Support Elements

Fielding a virtual training system based on COTS hardware involves considerations apart from those of the weapons platform. A virtual training system will generally operate within a building which must support the system's power and heating, ventilation, and air-conditioning (HVAC) requirements, as well as local environmental regulations. While

military personnel operate and maintain vehicles, industry or support contractor personnel often operate and maintain virtual training systems. Partner nations must be able to define these unique requirements during LOR formulation and provide DoD with information necessary to develop and execute the resulting FMS case.

BUILDING A LETTER OF REQUEST FOR A VIRTUAL TRAINING SYSTEM

DSCA publishes the *Foreign Customer Guide* (2014) as a "simplified overview of the process the United States … uses to transfer defense articles and services from the U.S. to friendly foreign governments or to specific international organizations" (p. 2). Appendix 1 of the *Foreign Customer Guide* is an "LOR Guide" which suggests information that partner nations can provide in order to ensure that DoD offers an LOA with sufficient cost and schedule to deliver, operate and sustain defense articles. Familiarity with information requested by the LOR Guide, as applicable to a virtual training system, allows the partner nation to submit an LOR for which DoD can offer a total package approach.

Capability Needs

Discussion of a partner nation's "capability needs" in drafting an LOR begins on page 24 of the LOR Guide. Unique capability needs for a partner nation's virtual training system result not only from incorporation of unique platform systems, but also from differences in how and where the partner nation uses the platform and the training system.

Desired Configuration

A partner nation that has purchased unique systems for the platform must identify these systems in the LOR for the virtual training system so that DoD and industry can determine how to incorporate these systems. If the DoD virtual training system *stimulates* an actual hardware system used in the weapons platform, the partner nation must provide, or request that DoD purchase, actual hardware and interface data for use in the virtual training system. If the DoD virtual training system *simulates* a weapons platform system using COTS hardware and custom software, the partner nation must provide, or request that DoD purchase, technical data in order to allow industry to develop the necessary software under the resultant FMS contract. As discussed in Coleman and Denny (2014), "a platform contractor may be reluctant to provide proprietary technical interface or performance data to a training system contractor who may be a competitor for either the live platform or the training system" (p. 7).

Operating Locations and Areas

The LOR Guide recommends that a partner nation discuss "where [the partner nation expects] to base those systems and where … their operational areas will be" (p. 24). Delivery of a virtual training system to a partner nation facility involves not only unique delivery, operation and sustainment requirements at the facility, but also implies unique requirements for the training system's synthetic environment such as the main operating base for the platform, training areas and ranges. In addition, the geographic Area of Responsibility (AOR) represented by the training system's synthetic environment may experience unique environmental or climatic conditions not present in the DoD training system.

Interoperability Requirements

The LOR Guide suggests that a partner nation describe requirements to be interoperable with its existing platforms, those of the United States, or with another nation (p. 24). Interoperability options for a virtual training system may include interaction with live, virtual, and constructive (LVC) platforms, synthetic environment correlation with these platforms, or mere synthetic representation of these platforms within the training system. In addition, interoperability requirements often involve information assurance, a key activity under the "Computer Resources" IPS Element. Partner nations wishing to define unique information assurance requirements or to interoperate an FMS virtual training system with existing systems must provide these requirements and related technical data to DoD.

CONOPS and Operational Tempo (OPTEMPO)

The LOR Guide describes requirements for CONOPS and OPTEMPO as "how will [the partner nation] employ them, how often will they be used, how long will the missions be, and under what sort of environmental conditions" (p. 24). CONOPS differences affecting the training system's synthetic environment include land vs. maritime operation, airfield vs. aircraft carrier deployment, and use of unique visual cues during maneuvers. A partner nation may envision a unique OPTEMPO for the training system itself, choosing to operate the system for differing numbers of days per week or hours per day. An OPTEMPO which differs from that employed by DoD will affect the total ownership costs, since increased OPTEMPO affects the scheduled maintenance requirements, sparing range and depth, and potentially

the mean time between failure (MTBF) rate component of the inherent availability (A_i) of the system. Discussion of unique OPTEMPO requirements in the LOR allows DoD life cycle logisticians to address the "Product Support Management" IPS Element to ensure that Operational Availability (A_o) requirements of the system will be met.

Acquisition

While DoD contracts with industry via the Defense Acquisition System to procure FMS articles and services, partner nations may elect to purchase elements of the platform or virtual training system with DCS, or to specify vendors for FMS articles and services.

Related Commercial Acquisition
Page 25 of the LOR Guide asks the partner nation to specify if the desired purchases will be exclusively by FMS, or by a combination of FMS and DCS. *SAMM* Section C5.2.1 emphasizes the need for advance planning and coordination for "hybrid" FMS and DCS purchases, and advises that "it is in industry's interest to advise the foreign purchaser [if] FMS articles or services will be required for the foreign purchaser to effectively use and sustain equipment being purchased through DCS and that the foreign purchaser must submit an LOR to obtain this support." In addition, "the USG is not bound to offer commitments made by industry, nor can it be held liable for inability to provide FMS support in conjunction with a DCS even if requested by the FMS purchaser."

If a partner nation pursues a hybrid purchase of a DCS training system in conjunction with an FMS purchase of the platform, it must consider whether DoD can deliver FMS platform hardware and technical data to allow the DCS-purchased training system to support either stimulation or simulation of platform systems. Conversely, if a partner nation pursues FMS for training systems based on DCS-purchased platforms, or for upgrades to DCS-purchased training systems, it may have to provide DoD and industry with platform hardware or technical data. In either situation, the partner nation must realize its responsibility to coordinate FMS and DCS deliveries.

Sole-Source Designation
SAMM Section C6.3.4 indicates that DoD will utilize "full and open competition" when procuring FMS articles and services, unless a partner nation "[submits] a written request … that [DoD] procure a defense article(s) and/or service(s) from a specific organization or entity, or that competition be limited to specific organizations or entities." Section C6.3.4.2 indicates that this request "should be submitted in the LOR, or it can be submitted separately with a reference to the LOR." Without such a request, DoD cannot guarantee that the manufacturer of the DoD system will be the manufacturer of the corresponding FMS system.

SAMM Section C6.3.4.4 allows a partner nation to direct use of a particular subcontractor. For FMS procurement of a virtual training system, specification of subcontractors to increase commonality with other partner nation training systems may improve interoperability and simplify sustainment. However, as Section C6.3.4.4 notes, "if problems occur in the performance or integration of the [subcontractor-provided] component, the FMS purchaser must bear the increased costs of correcting the problem." Hence, a partner nation must weigh the potential advantages of specifying subcontractors against the risks of directing DoD and industry to integrate unique hardware, software, or technical data.

Logistics

The LOR Guide recommends that partner nations describe existing logistics capabilities such as support equipment, personnel, and facilities. These capabilities are represented by several IPS elements.

Support Equipment
Application of the "Supply Support" IPS element for repair of platform hardware has connotations for stimulated use of that hardware in a virtual training system. A partner nation may wish to have dedicated training system maintenance personnel perform organizational-level maintenance on stimulated platform hardware used in the training system, separate from the supply chain used for live platform hardware. However, a partner nation may not have access to technical data or other capabilities required for intermediate- or depot-level repair of platform hardware. For hardware requiring return to the U.S., a partner nation can realize economies of scale in pursuing a common supply chain for hardware common to the live platform and training system.

Personnel

A partner nation's consideration of the "maintenance concept" discussed on page 26 of the LOR guide involves application of the "Maintenance Planning and Management" IPS element in identifying personnel to maintain a virtual training system. DoD generally offers post-installation Contractor Logistics Support (CLS), a short-term sustainment service provided by the training system manufacturer to augment existing training system maintenance activities as part of the total package approach for a virtual training system. Another, often less costly solution, is the use of a Contractor Operations and Maintenance of Simulators (COMS) services contract. This type of service is a holistic approach to operation, scheduled and preventative maintenance, and supply support requirements to sustain delivered training systems, and is often provided by either the system manufacturer or a third party provider. However, a partner nation may choose to extend CLS or pursue COMS through a third party outside of the FMS process.

Facilities

In order for DoD to apply the "Facilities and Infrastructure" IPS element during FMS case development and execution, DoD must know if a proposed site can support delivery, installation, and operation of a virtual training system, or an entirely new facility is required. The partner nation must request through an LOR any desire for DoD to pursue facility modifications or new construction, whether by commercial firms or by U.S. Government organizations such as the U.S. Army Corps of Engineers. Typical training system installations include the facility modifications necessary to interface the system to that facility, such as secondary electrical distribution panels and plumbing to chilled water for HVAC systems.

Country Data Requirements

The total package approach requires DoD to provide all items needed for standard operation and maintenance. However, the LOR Guide indicates that the partner nation should specify "additional data beyond that needed for standard operation and maintenance" (p. 26) that it desires to receive through the resulting FMS case. For a virtual training system, this may include network and synthetic environment interface documentation to support interoperability with other training systems. In addition, the partner nation may require test results to support certification or accreditation requirements from organizations within its government.

Training

While the entire LOR Guide suggests considerations for a partner nation in building an LOR for a virtual training system, the partner nation may consider the "Training" section on page 26 of the LOR Guide as requirements for training the personnel who operate and maintain the virtual training system in accordance with "Maintenance Concept" and "Training and Training Support" IPS elements. Virtual training systems based largely on COTS hardware are often maintained by industry, not by armed forces members or civilian government employees. The partner nation should specify in the LOR any desire to independently hire COMS support in order to begin the process for a third party transfer (TPT) determination of the virtual training system, related technical data, and documentation. The LOR Guide suggests that the partner nation specify preference for training in-country or in the United States (p. 26). A partner nation with an emerging virtual training capability may request that COMS personnel be trained at the training system manufacturer facility to establish proficiency.

Transportation

The LOR Guide recommends that a partner nation express "delivery preferences for the various types of material (major items, spares, munitions, publications), as well as any classified or hazardous materials" (p. 26) and refers to *SAMM* Chapter 7 for more information on FMS transportation (p. 27). Discussion with DoD training systems logistics subject matter experts prior to LOR submittal can lead a partner nation to request a delivery method best suited for a virtual training system, its envisioned entry point within the partner nation, and its installation location in accordance with considerations of the Packaging, Handling, Storage and Transportation (PHS&T) IPS Element. Some training systems, particularly those with collimated displays and motion-based platforms, require specialized shipping not available from many air freight forwarders. Sea surface shipment of a virtual training system may expose display and motion systems, specialized platform military hardware, and significant quantities of COTS computing hardware to harsh environmental conditions over a lengthy journey. DoD may recommend specialized commercial air cargo transport or use of the Defense Transportation System for transportation of large virtual training systems. Discussion

of transportation requirements for specialized material during formulation of the LOR allows DoD to ensure the resulting LOA accommodates the required transportation plan.

It is important to note that, per *SAMM* Section C7.3, the partner nation receives title for an FMS article after acceptance by DoD at the point of origin; as explained in Section C7.3.1, the point of origin for an item that DoD procures from industry is the manufacturer's facility. Hence, a partner nation must insure virtual training systems against loss or damage from pickup at the point of origin.

Program Development and Management

The LOR Guide raises the possibility that partner nations may "anticipate the need for U.S. assistance with defining … requirements and/or conducting a site survey," and that DoD may suggest assistance (p. 27). The LOR Guide also states that "special reports provided by [DoD] are above the Standard Level of Service so may incur additional costs," and that "*SAMM* Table C9.T2 provides DSCA guidelines on Standard Level of Service." Hence, partner nation-unique requirements for a virtual training system may require a technical assistance FMS case in order to fund DoD subject matter experts to aid in requirements definition.

Other Requests

The LOR Guide advises that a partner nation request any special contract terms in the LOR. Special contract terms may include partner-nation unique regulatory requirements. The "Design Interface" IPS Element requires that DoD comply with safety and environmental or hazardous material (HAZMAT) requirements. DoD virtual training system hardware must comply with U.S. regulations for operation and sustainment of the system within the United States. However, COTS components of a DoD system may not necessarily comply with specific partner nation safety or inspection requirements such as Restriction of Hazardous Substances Directives (RoHS) or "CE" mark certification required by European Economic Area agreements. The partner nation must include non-U.S. safety and environmental requirements in the LOR so that DoD can advise of technical performance, cost, and schedule impacts of design changes.

Many partner nations have external power requirements different from the U.S. standard. A DoD-supported site survey ensures that DoD and industry will procure the proper equipment to interface with available facility power. However, a partner nation may not wish to have U.S.-standard power interfaces on any equipment operating within the partner nation. As virtual training systems increasingly use COTS equipment, the partner nation must specify unique internal power interface requirements in the LOR for the training system, again allowing DoD to ascertain impacts of design changes.

Partner nations may also have unique certification or accreditation requirements for the virtual training system. A partner nation may wish to have an external aviation authority such as the European Aviation Safety Agency certify a flight simulator as being valid for aircrew training. As a DoD flight simulator may not undergo Federal Aviation Authority certification, the partner nation must request DoD or industry support for certification or accreditation efforts in the LOR.

SUMMARY OF LOR CONSIDERATIONS FOR A VIRTUAL TRAINING SYSTEM

Table 1 summarizes considerations for partner nations using the LOR Guide to build a Letter of Request for a virtual training system. However, while a partner nation may have exercised due diligence in developing unique, robust requirements for the training system, realities of acquisition contract execution and availability of supporting technical data may preclude implementation of all requirements.

Table 1- Considerations for LOR Development for a Virtual Training System

LOR Content		**Considerations for a Virtual Training System**	**IPS Elements**
Capability Needs	Desired Configuration	Representation of unique platform systems (stimulated vs. simulated)	
	Operating Locations and Areas	Synthetic environment implications of • Geographic AOR • Installation location • Training areas and ranges	
	Interoperability Requirements	• LVC training • Synthetic representation of other platforms • Synthetic environment correlation • Information assurance	Computer Resources
	CONOPS and OPTEMPO	• Synthetic environment implications of unique CONOPS • Implications of unique training system OPTEMPO	Product Support Management
Acquisition	Related Commercial Acquisition	• FMS technical data requirements for DCS training system • FGI requirements for commercial technical data to support FMS training system	
	Sole-Source Designation	• Manufacturers of DoD vs. FMS training systems • Partner nation-assumed risk of directed subcontractors	
Logistics	Support Equipment	Supply chain for platform vs. stimulated training system hardware	Supply Support
	Personnel	CLS or COMS (possibly procured outside of FMS)	Maintenance Planning and Management
	Facilities	• New or existing facility • Construction or modification (possibly procured outside of FMS)	Facilities and Infrastructure
Country Data Requirements		• Network and synthetic environment interface documentation • Test results to support certification or accreditation	
Training		• TPT implications for COMS support contractors • COMS training at manufacturer facility	Maintenance Concept Training and Training Support
Transportation		• Specialized shipping required for large training systems • Insurance for post-manufacturer pickup and delivery	PHS&T
Program Development and Management		Technical assistance FMS case to assist in requirements definition	
Other Requests		• Safety, environment, HAZMAT requirements for COTS hardware • Power interface requirements • Certification or accreditation requirements	Design Interface

CAVEATS OF UNIQUE REQUIREMENTS

Cost and Schedule Impacts

In defining unique requirements for virtual training systems procured under FMS, partner nations must consider cost and schedule impacts to acquisition contracts funded by the FMS case. Unique requirements may be best deferred to a subsequent FMS case or amendment after the training system has been delivered to the partner nation. However, partner nations may consider waiving unique requirements such as local power and environmental regulations in order to minimize program cost and shorten schedule.

Availability of Foreign Government Information (FGI)

While DoD strives to operate FMS on a total package approach, DoD may ask partner nations to provide software or technical data as foreign government information (FGI) in support of unique FMS requirements. DoD and industry partners may not possess intellectual property rights to support simulation or stimulation of unique platform subsystems within a virtual training device. Implementation of synthetic environment requirements may require a partner nation's mapping agency to provide geospatial intelligence (GEOINT) such as terrain elevation data, imagery, or digital maps. The partner nation's civil or military aviation authority may have to provide aeronautical technical data such as navigational aid (NAVAID) data, instrument approach procedures, or other data concerning airports. If a partner nation requires compliance with local power and environmental regulations, it must make these regulations and cognizant subject matter experts available to DoD and industry. Availability of FGI at the time of LOR submission assists DoD in offering a total package approach for the training system.

U.S. Regulatory Environment

Standard Terms and Conditions for every FMS case (found in *SAMM* Figure C5.F4) indicate that FMS operates under U.S. law and regulation (item 7.1). The *Foreign Customer Guide* indicates that the LOR review process "involves determining if the technology involved is releasable for export" (p. 11). Coleman and Denny (2014) provides discussion of the U.S. regulatory environment that drives exportability considerations for virtual training systems. In particular, partner nations must be aware of U.S State Department requirements for Technical Assistance Agreements and third party transfer agreements that facilitate transfers of defense articles, services, and technical data among governments and industry partners.

RECOMMENDATIONS

Success of the total package approach to development, delivery, operation and sustainment of an FMS virtual training system begins with a partner nation's documentation of unique, robust requirements in the LOR. DoD diligence in evaluating a partner nation's requirements, and industry awareness of the potential for unique partner nation requirements in the FMS environment, aids FMS case development and contract execution.

For Partner Nations

- Documentation of requirements specific to the partner nation would ensure that DoD can offer a total package approach and contract with industry to deliver a training system that meets partner nation expectations. Such requirements may include
    - Installation location within the partner nation, including specification of an existing facility or requirement to construct a new facility within or outside the FMS case
    - Anticipated method of transport of the training system from the vendor to the installation location
    - Real-world training areas for the live platform system which drive synthetic environment and GEOINT requirements for the training system
    - Types of vehicles and personnel unique to the partner nation to be simulated within the training system
- Documentation of certification and accreditation requirements and safety, environmental, HAZMAT, and power regulations *that the partner nation cannot waive* would ensure that DoD delivers a training system that can be legally operated within the partner nation.

- Documentation of availability of FGI to DoD and industry partners would reduce cost and schedule impacts of acquiring data through the FMS case. Such FGI may include
    - Technical data relating to interface and/or performance of systems unique to the partner nation's weapon platform configuration, particularly indigenous avionics systems, sensors, or external stores
    - GEOINT from the partner nation's mapping agency or aeronautical technical data from aviation authorities, to support development of the synthetic environment
    - Drawings and facility interface information necessary for installation of the training system
    - Interoperability requirements for interface with training systems operating within the partner nation
- Documentation of requirements for operation and sustainment of the training system by industry or support contractor personnel would raise U.S. Government awareness of the requirement for a third party transfer agreement through the U.S. State Department.
- Prudent prioritization of requirements for an initial FMS case for a training system would ensure timely initial delivery of the training system, while allowing for upgrades via subsequent FMS cases or amendments.
- Coordination with the SCO prior to LOR submission for a virtual training system, including possible request of a technical assistance FMS case, would ensure that appropriate DoD personnel can assist in requirements development.

For DoD

- Development of system-specific checklists for FMS virtual training systems in accordance with DSCA Policy Memo 18-09 and *SAMM* C5.1.2.2 would reduce case development cost and schedule, and help ensure delivered systems meet expectations of partner nations.
- Anticipation of technical and logistic requirements unique to a partner nation's operating location and areas would allow DoD to develop and deliver a virtual training system suited to the partner nation's geography.
- Assessment of a partner nation's unique technical requirements during FMS case development would ensure that industry and DoD deliver a valid training system with minimal technical risk.
- Offer of a technical assistance FMS case to assist a partner nation in developing virtual training system requirements would ensure that the partner nation submits an LOR that DoD can use to develop and execute an FMS case for the training system.

For Industry

- Awareness of the presence of unique systems in the partner nation's live platform configuration would lead industry partners to propose necessary development efforts and technical data licensing for FMS training system contracts.
- Awareness of the need to utilize FGI during FMS contracts for virtual training systems may lead industry partners to accommodate technical data from commercial, DoD, and international sources in training system design to establish competitive advantage.
- Conformance to international regulatory requirements during design of a DoD virtual training system design would result in a lower price for subsequent FMS and DCS training systems, increasing appeal of the system with partner nations.
- Advice to partner nations of the need for coordination or delivery of technical data delivery in an LOR for new or upgraded platform hardware systems purchased via FMS would ensure that a virtual training system delivered via DCS can replicate or simulate the behavior of these hardware systems in a synthetic environment.

CONCLUSION

The total package approach to FMS allows partner nations to acquire all articles and services required to operate and sustain U.S.-origin defense articles, including virtual training systems. A partner nation must document unique training system requirements in an LOR in order to allow DoD to offer accurate cost and schedule for delivery, operation, and sustainment of the training system. Cost and schedule considerations, availability of technical data from the partner nation, and regulatory environments within the partner nation and the U.S. may limit implementation of unique requirements. An LOR containing unique, robust requirements for a virtual training system allows DoD to develop and offer an accurate LOA, and to contract with industry to deliver a valid system within partner nation cost and schedule constraints.

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