Human Systems Integration (HSI) & the Life Cycle Sustainment Plan (LCSP)

Jamie M. Suter
AFLCMC/LZSA
June 2023

Agenda

- **Policy**
- **Importance**
- **LCSP V3.0 Outline**
- **HSI-Related Content & Critical Thinking Questions**
- **Summary & Questions**

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Policy

- **10 USC 4324: Law requires Product Support Managers (PSMs) to develop a comprehensive product support strategy (PSS)**
  - **LCSP is most comprehensive & organized way of satisfying requirement.**
  - **LCSP embodies the PSS & is the "detailed product support plan, including sustainment metrics, risks, costs, & analyses used to deliver the performance-based best value strategy covering the Integrated Product Support (IPS) elements." (*DoDI 5000.91, Product Support Management for the Adaptive Acquisition Framework*.)**
- **DoD 5000.91: Outlines LCSP expectations, update cycles, required info.**
- **LCSP Outline Version 3.0. added Human Systems Integration Plan as a new required appendix**
- **DoDI 5000.95: Addresses HSI planning & procedures, including application across the following domains: Human Factors Engineering (HFE), Personnel, Habitability, Manpower, Training, Safety & Occupational Health (SOH), & Force Protection & Survivability (FP&S)**

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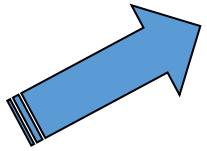
HSI Domains & the 12 IPS Elements

- **HSI domains**
  1. **Human Factors Engineering (HFE)**
  2. **Personnel**
  3. **Habitability**
  4. **Manpower**
  5. **Training**
  6. **Safety & Occupational Health (SOH)**
  7. **Force Protection & Survivability (FP&S)**

- **These domains touch a range of integrated product support (IPS) element areas covered in the LCSP**



- **12 Integrated Product Support Elements**
  1. **Product Support Management**
  2. **Design Interface**
  3. **Sustaining Engineering**
  4. **Supply Support**
  5. **Maintenance Planning & Management**
  6. **Packaging, Handling, Storage & Transportation**
  7. **Technical Data**
  8. **Support Equipment**
  9. **Training & Training Support**
  10. **Manpower & Personnel**
  11. **Facilities & Infrastructure**
  12. **Information Technology Systems Continuous Support**

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LCSP Outline V3.0 (13 Oct 22)

- Overview & Expectations of the LCSP
- 1. Introduction
- 2. Product Support Strategy
- 3. Product Support Performance
- 4. Sustainment Strategy & the Product Support Package
- 5. Other Sustainment Considerations
- 6. Influencing Design & Sustainment
- 7. Program & Design Reviews
- 8. Integrated Schedule
- 9. Program Funding & Life Cycle Cost Estimate
- 10. Management
- 11. LCSP Annexes
- 12. Acronyms

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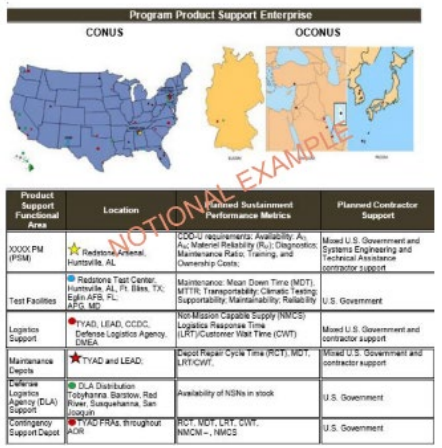
Section 2: Product Support Strategy (PSS)

Purpose: overarching approach to meet sustainment requirements

- **HSI Critical Thinking Questions:**
  - **Are HSI equities depicted in the Product Support Enterprise (Figure 2-3)?**
  - **Do operational & maintenance concepts address the human contribution to total system performance & inform HSI domain trade-off analyses?**
  - **What data is needed to describe the capabilities & limitations of the product support enterprise to influence human-centered design trade decisions early in the life-cycle?**
  - **Are HSI & Supportability equities synchronized to the relevant IPS elements & included & implemented during the systems engineering process (i.e. in sync with SEP)?**

Figure 2-3: Product Support Enterprise
Include as-of date



Attention to HSI in PS represents 20%-40% ROI of Life Cycle Costs

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Section 3: Product Support Performance

Purpose: Sustainment performance requirements (ID, observe, measure)

- ## 3.1 Performance Requirements Impacting Sustainment

Requirement	Documentation	Threshold / Objective	RFP/Contract	TEMP	IOC FY XX	FOC FY YY	Full Fielding FY ZZ
Human Systems Integration (HSI)	AoA, CDD Update 5.3, Human Factors Engineering (HFE) domain, System Usability Score (SUS) scale	Usability (design characteristic, SUS), 90% / 100%	RFP – PWS 4.1.2	TEMP 4.6, User assessment, Log Demo	70%	90%	90%
		Situational Awareness (design characteristic) 90% / 100%			95%	98%	98%

- ## 3.2 Performance Demonstrations & Tests that Impact Sustainment

Test	Requirement	Metric / Feature	Schedule	Performance Goal	Estimate Value/ IOC Estimate	PSM Assessment
Human Factors Engineering (Usability)	SEP, CDRL A003, TEMP	End to End Mission Performance Usability (designed attributes to schedule)	2026	95%	70%	On Track

- ## 3.3 Monitoring Sustainment Performance

Tool	OPR/IPT	Metrics/Data Monitored	Feedback Mechanism	Review Timeframes
Sustainment Reviews, Independent & Logistics Health Assessments	PSM IPT (includes HSI representative)	Focus on statutory requirements & track O&S cost growth. All 12 IPS elements.	PSI & PSP input; DASM(MR) summary reports	LHAs Annually, SRs Every 5 years

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Section 3: Product Support Performance

- **HSI Critical Thinking Questions:**
  - **Are HSI requirements consistent with the Program's HSI Plan & the SEP?**
  - **Has HSI analysis been planned or performed addressing all the following:**
    - **Operators**
    - **Maintainers**
    - **Support personnel**
  - **Is HSI included in sustainment performance monitoring activities?**

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Section 4: Sustainment Strategy & Product Support Package

Purpose: Details the product support package addressing integration, planning, & implementation of all 12 IPS elements, requirements that drive design & sustainment, stakeholder relationships, & execution risks

- **4.1 Supply Support (N/A)**
- **4.2 Packaging, Handling, Storage & Transportation (PHS&T) Planning**
  - **Does planning include HSI practitioners review of material-handling equipment to reduce labor-intensive material-handling operations?**
- **4.3 Maintenance Planning & Management**
  - **4.3.1 Maintenance Concept & 4.3.2 Depot Activation Planning**
  - **Are HSI logistics factors (e.g., accessibility & Human Factors Engineering) included for all maintenance levels?**
  - **Has program planned for task analysis to address ease of maintenance or accessibility & standardization?**

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Section 4: Sustainment Strategy & Product Support Package

- **4.4 Design Interface & Sustaining Engineering**
  - **Does design account for HSI considerations / aligned in HSIP, SEP, TEMP, & LCSP?**
  - **Is Product Support & Systems Engineering collaboration reflected in planning & reviewing Failure Modes, Effects, & Criticality Analysis (FMECA); Reliability, Availability, & Maintainability (RAM); reliability growth planning; Failure Reporting & Corrective Action System (FRACAS), Fault Tree Analysis (FTA), Maintenance Task Analysis (MTA), & Level of Repair Analysis (LORA) activities? These processes ensures a common understanding of failure modes & impacts to technical manuals, training, manpower & skillsets.**
  - **Is there a plan for data capture & analysis to support CBM+ implementation?**
  - **Have all relevant HSI domains & considerations been included in modifications?**

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Section 4: Sustainment Strategy & Product Support Package

– 4.4.1 Supportability Analysis: List analytic methods & tools to define the PSP

Product Support Analytical Methods & Tools				
Process/Analysis	**Schedule**	**Tool**	**Output Product**	**Review/Update**
Maintainability Analysis & Prediction	Xxx	MIL-HDBK-472	Maintenance Concept	Dev. Test, OT&E
Maintenance Task Analysis	Xxx	YYY proprietary software & PowerLog-J Logistics Product Data Database	Draft Mx Procedures	CDR, MS C, OT&E
Training System Requirements Analysis	Xxx	SCORM	Training Programs of Instruction	MS C
Manpower Analysis	Xxx	Logistics Composite Model (LCOM), Manpower Authorization Criteria	Manning Recommendations	MS C

- **4.4.1.1 Supportability Trades: Are human-centered design considerations & readiness risks addressed through trade-off analyses among the HSI domains?**

Supportability Trades (Planned or Completed)				
Trade	**IPT**	**Options Analyzed**	**Results**	**Impact**
Device Portability: **Attached power cable vs. replaceable batteries**	HSI	**Portability**: attach points, handles, size, cabling; **Power**: battery mgmt. logistics, cabling, heat, noise, interfaces; **Calibration**: time, periodicity, complexity	Enter text here	Battery Logistics Costs. Time impact for replacing batteries
XYZ Engine: **Reliability vs. Maintenance vs. Cost**	R&M	Increased engine reliability	• Personnel & time reduction for maintainability • Increased safety, supportability, operability, Reduced trg time/increased trg effectiveness	Increase Ao
Pers. Resource Rqmts: **Reduction in # of pers. vs. human performance**	HSI	**Workload**: fixed amount of work (maintenance tasks): **Habitability**, **Safety**, **Survivability**	Reduced crew = increased workload; longer work hours = cumulative fatigue; increased mistakes, errors, equip. damage	Increase in Mx downtime. Decrease in mission capability.

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Section 4: Sustainment Strategy & Product Support Package

– 4.4.2 Design Analysis: Describe any significant maintainability-related design changes made as a result of human engineering recommendations

Sustainment in Key Design Considerations				
Design Consideration	**Key Subsystems**	**Sustainment Issues**	**Planned Review/Updates**	**Impact/Comments**
Interface Design	Display	Reliability lower than rqmt. Location probits maintenance accessibility	CDR, DT, OT&E	Ao impacted due to increased MTTR. Redesign inwork. Assess impacts to PSP after analysis.
Human Systems Integration (HSI)	Mission Equipment, Training Devices, O&S infrastructure	HSI not addressed in requirements documents.	SRR, Each acquisition milestone review & SETR	Increased ownership costs to add human performance accommodations to total system.
Desert Operations	Environmental, Hydraulic, O&S infrastructure	Filters; Contamination; Maintenance Crew Heat Stress; Reduced battery shelf life	SRR, PDR, CDR, DT & OT, IOC, FRP, Sustainment Reviews	Increased filter changes; filter demand; inspection cycles; Environmentally-controlled facility rqmts for maintenance ops & battery storage

– 4.4.3 Failure Modes, Effects, & Criticality Analysis (FMECA)

FMECA Summary			
System/IPT Lead	**Schedule**	**Failure Mode Description**	**Recommended Action**
Avionics	Complete	New failure modes uncovered which current health monitoring system cannot predict.	Design out diagnostic ambiguity groups that cause unnecessary removals considering the new failure modes.
Airframe	Update after IOT&E	• New failure modes uncovered due to projected corrosion issues around engine inlets & on wing spar • Fuel tanks moved • Ejection seat initiator fails in high humidity Environment	• Update LORA to determine impact to organizational scheduled maintenance. Ensure there are sufficient doors & panels to allow **accessibility** to critical areas. Ensure panels, doors, etc. are interchangeable between aircraft & designs meet support event frequencies in terms of access & its 3-dimensional access plane. • Verify fuel tanks not adding stress to bulkheads resulting from high “G” ops • Add desiccant & indicator, move to left side of seat for easier access

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Section 4: Sustainment Strategy & Product Support Package

- **4.4.4 Reliability: ID reliability drivers & issues affecting O&S cost**
  - **Are HSI considerations included in reliability driver mitigation efforts?**
  - **ID impacts to maintenance procedures, repair capabilities, manpower, & training, & mitigation actions, including potential actions if the allocation is not achieved.**

Subsystem Config. Item	Reliability Allocation	Current Reliability Estimate	O&S Cost Impacts	Mitigation Efforts
High Power Amplifier	6K hrs MTBR	3.5K hrs MTBR	#18M/yr (Cyxx$)	**TMRR:** Evaluate design changes to improve reliability **EMD:** ID corrective actions for failures during DT prior to MS-C. **Production**: Conduct trade study on spares vs. design change **O&S:** Assess ability to acquire more spares considering DMSMS issues or perform a tech refresh or engineering change to address reliability & DMSMS issues HSI ?

- **4.5 Technical Data:**
  - **Are HSI-related technical data & intellectual property requirements addressed? Examples:**
    - **DI-HFAC-80746, Human Engineering Design Approach Document - Operator**
    - **DI-HFAC-80747, Human Engineering Design Approach Document-Maintainer**
    - **DI-SESS-81758, Logistics Product Data, Etc…**

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Section 4: Sustainment Strategy & Product Support Package

- **4.6 Information Technology (IT) Systems Continuous Support**
  - **4.6.1 Cybersecurity**
  - **4.6.2 Software Sustainment & Software/System Operability**
    - **Have HSI considerations been incorporated into software development, integration, & test phases to include graphical user interface, usability testing, control & display layout, human error/reliability analysis, & on-line user guides & documentation?**
  - **4.6.3 Digital Product Support**
    - **Are model-based activities part of HSI analysis efforts? e.g., Human Engineering Design Approach Document (HEDAD)-Maintenance to evaluate interfaces for primary system & support equipment. Product Life-cycle Management (PLM) integration?**
- **4.7 Manpower & Personnel**
  - **Have any HSI analysis been conducted? *(e.g., Task Analysis & Manpower analysis*)**
  - **Do planned engineering designs minimize personnel rqmts & keep human aptitudes necessary for operation & maintenance at levels consistent with what will be available in user population at time fielding OR will new occupational specialties be required?**

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Section 4: Sustainment Strategy & Product Support Package

- **4.8 Training & Training Support**
  - **Is section consistent the System Training Plan (STP)?**
  - **Do training plans address individual or crewed training, maintainer training, system of systems training & training multiple occupations; as applicable in all phases of lifecycle?**
  - **Does planning indicate required levels of Logistics Product Data maturity to support STP?**
- **4.9 Support Equipment**
  - **For new support equipment, are op & mx training requirements included in planning efforts?**
- **4.10 Facilities & Infrastructure (Including Leveraging Enterprise Opportunities Across Programs & DoD Components)**
  - **Does this section include habitability requirements? (e.g., living areas, personal hygiene facilities, working areas, living areas, & personnel support areas)**
- **4.11 Sustainment Relationships**
  - **4.11.1 Product Support Arrangements**
  - **4.11.2 Contract Product Support Integrators & Product Support Providers**
  - **4.11.3 Organic Product Support Integrators & Product Support Providers**

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Section 5: Other Sustainment Considerations

- 4.12 Product Support Risk, Issue or Opportunity Management
  - 4.12.1 Obsolescence Risk Management
  - 4.12.2 Supply Chain Risk Management
  - 4.12.3 Manufacturing Risk

- **5 Other Sustainment Considerations**
  - 5.1 Competition in Sustainment
  - 5.2 Property Management
  - 5.3 Cross-Functional Sustainment Considerations
    - Address HSI activities that impact sustainment & highlights risks that are design &/or cost drivers, especially as they impact the system's IPS elements (if not addressed elsewhere).

Cross-Functional Sustainment Issues	Document	Impact or Risk to Product Support Elements
Human Systems Engineering	DoDI 5000.95 HSIP	Address impacts not covered elsewhere
Artificial Intelligence or Machine Learning	SOW	Interface with Human-in-the-loop

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Sections 6 & 7: Influencing Design & Sustainment; Reviews

- **6 Influencing Design & Sustainment**

Requirement	Documentation	Review
Human Systems Engineering	DoDI 5000.95; HSIP; Training Systems Plan; RFP; HEDAD-M/DI-HFAC-80747 DID; etc.	• System's ILA/SR across the lifecycle • Design Reviews prescribed in AAF pathway (e.g., SETRs) • Post-IOC reviews
Manpower Analysis & Estimate Reporting (10 U.S.C §2434)	CARD; ICE; POE' O&S cost estimate	• System's ILA/SR across the lifecycle • Design Reviews prescribed in AAF pathway (e.g., SETRs) • Program Reviews (e.g., MS-A, MS-B, MS-C, Post-IOC reviews
System Safety/ESOH (DoDI 5000.88, MIL-STD-882)	SEP; System Safety Plan; HMMP; Haz Analysis	• Various, as early as possible in lifecycle & update as needed

  - **How do the analyses/plans in Table impact the product support strategy?**
  - **Do the requirements create program cost drivers?**

- **7 Program & Design Reviews: Ensure HSI is depicted in criteria**

Review	Sustainment Participants	Entry/Exit Criteria	Sustainment Focus/Findings	Open Sustainment Actions
PDR	PSM IPT	• Ref PDR Checklist	• Reliability estimates • FMECA results/maturity	• PDR 20xx-1: Late delivery of preliminary FMECA's impacting delivery of LORA & MTA
CDR	PSM IPT	• Ref CDR Checklist	• Reliability estimates	• CDR 20xx-5: LRU-3 reliability is less planned: 3 circuit cards contribute to 90% of failures; investigate design or mfg. issue
SR & ILAs	PSM IPT	• Ref SR Checklist		

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Sections 8 & 9: Schedule, Funding & Costs

- 8 Integrated Schedule HSI ?
- 9 Program Funding & Life-Cycle Cost Estimate
  - 9.1 Program Funding
  - 9.2 Development & Evolution of the System O&S Cost Estimate
    - 9.2.1 O&S Cost Estimate
    - 9.2.2 Disposal Cost Estimate
    - 9.2.3 O&S & Disposal Cost Drivers
  - 9.3 O&S & Disposal Cost Reduction Initiatives (Should Cost)
  - 9.4 O&S Cost Affordability Constraints
  - HSI Critical Thinking Questions:
    - Are HSI-related initiatives included in reduction initiatives (e.g. reduce mx manpower)
    - What costs are within the Program Office's control & which are controlled by other stakeholders or outside factors?
    - Have relevant functional area SMEs been involved in all prior coordination activities to understand additional trade-off opportunities for cost mitigation?

HSI ?

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Sections 10: Management Organization

- **10 Management**
  - **10.1 Program Organizational Structure**
  - **10.2 Product Support Team**

Name	POC	Stakeholders (by Function or Org)	Role, Responsibility, & Authority	Products & Metrics
PS IPT	PSM	• Program Office ○ PSM, Deputy PM, Sys Eng. Lead, Financial Lead, SW Lead, Site Rep., R&M Lead • HSI Lead • PSIs; PSPs; Sustainment command Reps • DoD Agency Representative(s) • Key Subcontractor or Suppliers (Engine, XX) Size: YYY	Integrate all PS efforts • Team Member Responsibilities • Cost, Performance, Schedule Goals • Scope, Boundaries of IPT Responsibilities Schedule & frequency of meetings Date of signed IPT charter & signatory	Products: • LCSP/LCSP Updates; Integrated Master Plan (IMP)/IMS Inputs; Specifications, Acquisition Strat. Input, Corrosion Prevention Plan Metrics: • Cost: IPS Element costs, Operating Targets • Schedule • Sustainment: Am, Log Footprint, etc..
HSI IPT	HSI Lead	• Program Office ○ PSM or Log Mgr, Deputy PM, Sys Eng. Lead, Financial Lead, SW Lead, Site Rep., R&M Lead • HSI Lead/SME Size: YYY	Integrate all HSI-related PS efforts • Team Member Responsibilities • Cost, Performance, Schedule Goals • Scope, Boundaries of IPT Responsibilities Schedule & frequency of meetings Date of signed IPT charter & signatory	Products: • LCSP/LCSP Updates; IMP/IMS Inputs; HSI Plan Updates; SEP updates; Acquisition Strat. Input; Models (MBSE/MBPS) Metrics: • HSI domains by IPS Element • Cost: IPS Element costs, Operating Targets) • Sustainment: Ao, Am, Log footprint

  - **HSI Critical Thinking Questions:**
    - **Is there an HSI IPT, if not, why not?**
    - **Is an HSI representative included in the organization or matrixed from a staffing org?**

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Sections 11: LCSP Annexes

- **11 LCSP Annexes**
  - **11.1 Component Required Annexes**
    - **Product Support Business Case Analysis** ***(DoDI 5000.91)***
    - **Independent Logistics Assessment & Corrective Action Plan** ***(DoDI 5000.91)***
    - **System Disposal Plan** ***(DoDI 4160.28; DoDM 4160.21; DoDM 4160.28)***
    - **Preservation & Storage of Unique Tooling** ***(PL110-417, T7, Sub B, § 815; DFARS 207.106 [S-73])***
    - **Core Logistics Analysis** ***(DoDI 5000.91; DoDI 4151.20) & DSOR Assignments (DoDI 4151.24)***
    - **Replaced System Sustainment Plan (RSSP)** ***(Title 10 U.S.C. § 4321, formerly § 2437)***
    - **Technical Data & Intellectual Property Plan** ***(DoDI 5010.44)*** **– no later than FRP/FD decision**
    - **Corrosion Prevention & Control Plan** ***(Title 10 U.S.C. § 2228; DoDI 5000.67)***
    - **Diminishing Manufacturing Sources & Material Shortages (DMSMS) Plan** ***(DoDI 4245.15)***
    - **Programmatic Environment Safety & Occupational Health Evaluation (PESHE) & National Environmental Policy Act (NEPA)/Executive Order (E.O.) 12114 Compliance Schedule** ***(Title 42 U.S.C. § 4321 (National Environmental Policy) & (Executive Order 12114)***
    - **Human Systems Integration Plan (HSIP)** ***(DoDI 5000.95)***

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Outline Structure Cross Reference

OLD LCSP Outline V2.0 (2017)	NEW LCSP Outline V3.0 (2022)
Overview	Overview & Expectations of the LCSP
1. Introduction	1. Introduction
2. Product Support Performance	3. Product Support Performance
3. Product Support Strategy	2. Product Support Strategy 5. Other Sustainment Considerations
4. Program Review Issues & Corrective Actions	7. Program & Design Reviews
5. Influencing Design & Sustainment	6. Influencing Design & Sustainment
6. Integrated Schedule	8. Integrated Schedule
7. Cost & Funding	9. Program Funding & Life Cycle Cost Estimate
8. Management	10. Management 4. Sustainment Strategy & the Product Support Package
9. Supportability Analysis	4. Sustainment Strategy & the Product Support Package
10. LCSP Annexes	11. LCSP Annexes
11. Acronym List	12. Acronyms

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