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COURSE SYLLABUS

SL 5G

USAREUR-AF

COURSE SYLLABUS — SL 5G: ADVANCED OPERATIONS RESEARCH/SYSTEMS ANALYSIS

Maven Smart System (MSS) — USAREUR-AF

HEADQUARTERS
UNITED STATES ARMY EUROPE AND AFRICA
(USAREUR-AF)
Wiesbaden, Germany

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COURSE SYLLABUS — SL 5G: ADVANCED OPERATIONS RESEARCH/SYSTEMS ANALYSIS

MAVEN SMART SYSTEM (MSS) — USAREUR-AF

Field	Detail
Level	SL 5G — Advanced ORSA Specialist Track
Duration	5 days (40 hours)
Prerequisites	SL 4G complete (Go evaluation on file); 18+ months active ORSA experience or graduate-level OR/MS program (concurrent enrollment accepted); demonstrated proficiency with Python or R and validated quantitative models in an operational context
Audience	Senior FA49 officers and analysts, theater-level ORSA practitioners, data scientists in advanced analytical roles
Format	Seminar + advanced lab + peer-reviewed analytical product
Location	MSS Training Environment (Code Workspace provisioned, GPU allocation confirmed)

PREREQUISITE WARNING: SL 5G is not required for the majority of ORSA billets. It is intended for personnel actively assigned to advanced modeling, campaign analysis, or platform architecture roles at theater level. If uncertain whether this track applies to your billet, consult your supervisor or C2DAO before enrolling.

BLUF: SL 5G moves beyond SL 4G's operational modeling toolkit to the methods and standards required for theater-strategic analytical products — campaign analysis, multi-echelon optimization, Bayesian inference under deep uncertainty, and agent-based simulation. Products from SL 5G analysts inform GO/SES decisions and alliance planning. The standard at this level is not just technical correctness — it is interpretability, peer reviewability, and honest uncertainty characterization.

LEARNING OBJECTIVES

#	Objective
1	Apply Bayesian inference for operational decision analysis: posterior estimation, conjugate priors, hierarchical models for multi-echelon data
2	Build agent-based simulation models for complex adaptive scenarios (logistics, attrition, route analysis) with documented calibration and validation
3	Design and execute multi-objective optimization models; navigate Pareto tradeoffs; communicate tradeoff implications at the operational and strategic level
4	Apply network analysis (graph theory, centrality, flow) to operational problems: supply chain resilience, communications network vulnerability, task organization analysis
5	Build ensemble and stacked model architectures; conduct rigorous out-of-sample validation; document bias-variance tradeoffs
6	Produce a theater-level ORSA analytical report meeting USAREUR-AF GO/SES product standards: uncertainty quantification, assumption documentation, peer review, reproducibility
7	Conduct and document a peer review of another analyst's model and product; identify methodological weaknesses and limitation gaps

PRE-COURSE CHECKLIST

Complete **10+ duty days before Day 1:**

- ☐ Confirm Code Workspace access with GPU allocation (contact C2DAO — standard access is insufficient)
- ☐ Install and test: scipy, statsmodels, pymc3 (or equivalent Bayesian library), networkx
- ☐ Read TM-50G, Chapter 1 (Advanced ORSA Standards) in full — the peer review and uncertainty documentation requirements are assessed on Day 5
- ☐ Prepare a 1-page description of a current or recent operational analytical problem from your unit — you will use this for the Day 5 product exercise

DAILY SCHEDULE

Day 1 — Bayesian Methods for Operational Analysis

Time	Block	Method	Content
0800–0900	1	Seminar	SL 5G standards: peer review requirements, uncertainty documentation, GO/SES product expectations
0900–1100	2	Lab	Bayesian inference: prior selection, likelihood functions, posterior estimation — operational examples (casualty estimation, readiness probability)
1100–1115	—	Break	
1115–1200	3	Lab	Conjugate priors; binomial/beta model for readiness probability; documenting prior assumptions
1200–1300	—	Lunch	
1300–1500	4	Lab	Hierarchical Bayesian models: multi-echelon readiness pooling; partial pooling vs. no pooling tradeoffs
1500–1515	—	Break	
1515–1700	5	Lab	Bayesian updating: incorporating new LOGSTAT data into existing posteriors; sequential analysis patterns

Evening reading: TM-50G, Chapter 2 (Agent-Based Simulation) — sections on calibration and operational scenario design.

Day 2 — Agent-Based Simulation and Network Analysis

Time	Block	Method	Content
0800–0830	—	Review	Bayesian questions; common prior misspecification errors
0830–1030	6	Lab	Agent-based simulation: Mesa/NetLogo patterns; defining agents, environment, and interaction rules; logistics convoy simulation
1030–1045	—	Break	

Time	Block	Method	Content
1045–1200	7	Lab	Calibration and validation: parameter sweeps, sensitivity to initial conditions; comparing to historical analogues
1200–1300	—	Lunch	
1300–1500	8	Lab	Network analysis: graph construction, centrality measures, shortest path; supply chain resilience analysis
1500–1515	—	Break	
1515–1700	9	Lab	Network vulnerability: removing critical nodes; communications network fragility; task organization restructuring analysis

Evening reading: TM-50G, Chapter 3 (Multi-Objective Optimization) — Pareto frontier and tradeoff communication sections.

Day 3 — Multi-Objective Optimization and Ensemble Methods

Time	Block	Method	Content
0800–0830	—	Review	Simulation calibration check; network analysis output review
0830–1030	10	Lab	Multi-objective optimization: objective function design, constraint formulation, Pareto frontier computation
1030–1045	—	Break	
1045–1200	11	Lab	Communicating Pareto tradeoffs to commanders: translating the frontier into operational COA options
1200–1300	—	Lunch	
1300–1500	12	Lab	Ensemble methods: bagging, boosting, stacking; cross-validation architecture; out-of-sample validation
1500–1515	—	Break	
1515–1700	13	Lab	Bias-variance tradeoff documentation; model complexity justification; limitation documentation standards

Evening reading: TM-50G, Chapter 7 (Senior-Level OR Products and Briefings) — complete read before Day 4 product work.

Day 4 — Product Standards and Peer Review

Time	Block	Method	Content
0800–0900	14	Seminar	GO/SES ORSA product standards: structure, uncertainty section, assumption register, peer review signature block
0900–1100	15	Workshop	Draft analytical product from participant's prepared operational problem (see pre-course checklist)
1100–1115	—	Break	
1115–1200	16	Workshop	Continue product development; instructor circulates for individual feedback
1200–1300	—	Lunch	
1300–1500	17	Peer Review	Structured peer review exercise: exchange draft products; apply the SL 5G peer review checklist
1500–1515	—	Break	
1515–1700	18	Debrief	Peer review findings; common gaps; revise products based on feedback

Evening reading: Revise analytical product incorporating peer review feedback; prepare for Day 5 evaluation.

Day 5 — Advanced Integration and Practical Evaluation

Time	Block	Method	Content
0800–0900	19	Review	Product revision questions; evaluation briefing
0900–1000	20	Brief	Practical evaluation scenario brief and planning time
1000–1015	—	Break	

Time	Block	Method	Content
1015–1200	21	**Eval**	**Evaluation Part 1:** Advanced method application (Bayesian model or optimization on provided dataset)
1200–1300	—	Lunch	
1300–1600	22	**Eval**	**Evaluation Part 2:** Produce GO/SES-ready analytical product; submit for peer review
1600–1700	23	Review	Evaluator feedback; graduation requirements review

PRACTICAL EXERCISE

Scenario: Theater-level logistics analysis for campaign planning. The G4 requires: a Bayesian readiness probability estimate for two maneuver brigades, a supply chain resilience analysis (network), and a multi-objective optimization of two sustainment COAs trading cost against risk.

Go standard: Pass 4 of 5 product elements. Product must include: uncertainty quantification on all estimates, assumption register, peer review complete, all models reproducible with set seed or documented parameters.

PEER ADVANCED TRACKS

Track	Relevance to SL 5G
SL 5H (Advanced AI Eng)	AI-augmented analytical pipelines; LLM-assisted pattern recognition in ORSA products
SL 5M (Advanced ML Eng)	Advanced model architectures (ensemble, Bayesian) used in ORSA modeling; drift detection for deployed ORSA models
SL 5J (Advanced PM)	Communicating ORSA findings at portfolio level to GO/SES audiences; resource allocation analysis feeding PM dashboards

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