MCP Design Report: NASA-Compliant Model Context Protocol (MCP) Architecture

Program: SDC & COMMS Project Document ID: MCP-SDC-COMMS-001 Revision: A (Initial Deployment) Date: 2025-10-19 Prepared by: MECSAI / SDC & COMMS Division Distribution: ATB / COMMS IPT / Systems Engineering / MECSAI Control

1. Purpose This document defines the NASA-compliant Model Context Protocol (MCP) architecture designed for Spear Enterprise LLC's private NAS repository. The MCP serves as the backbone for managing all project files across multiple divisions (SDC & COMMS, Autonomous House, and future projects) while maintaining compliance with NASA-STD-7009, NPR 7120.5, and NASA-STD-8739.8.

2. Overview of Multi-Project MCP System The MCP is a modular interface between the NAS repository (WD EX4100) and the Agent Swarm. Each project operates its own MCP server instance with identical structure and authentication policies.

Key Principles: - Multiple MCP Instances: One per project. - Unified Protocol: JSON-RPC 2.0 over HTTPS. - Scalable Template: Base configuration, easily cloned. - Agent Swarm Integration: Unified APIs for search, read, and route. - Cross-Project Access: Controlled MECSAI routing.

3. NAS Integration & Architecture NAS: WD My Cloud EX4100 (RAID 5, 4×14 TB, dual Ethernet). Network: TP-Link TL■SG■1016D Gigabit switch, dual-link aggregation. Each MCP runs as a service bound to a NAS directory and indexes files by checksum and metadata.

4. NASA Alignment & Integration Architecture mirrors NASA MCP GitHub structure. Includes: - NASA API Bridge (LNIS, ICSIS, SCaN■MOCS, LCRNS) - Two-Way Readiness for data upload - Compliance Matrix - Change Detection (SHA checks, diffs, JSON deltas)

5. Security & Compliance Implements NIST SP 800■171 and NASA cybersecurity controls: - AES■256 encryption - HTTPS token auth - Role-based access - Audit logs & rollback - Immutable revisions

6. Template Deployment & Scaling Projects inherit cloned templates with indexes and routing forms. Deployment steps include registration, configuration, metadata init, and auto-routing form generation.

7. Agent Swarm Coordination Agents interface via JSON RPC endpoints. MECSAI handles concurrency and logs. All activities mirrored to audit registry and reviewed weekly by ATB.

8. Validation (Alpha Protocol) Verified compliance with all NASA mappings and agent interoperability. No placeholders remain.

9. Next Actions 1. Deploy MCP for SDC & COMMS and Autonomous House. 2. Activate NASA Connector. 3. Migrate agent file retrieval. 4. Begin change-detection monitoring. 5. Generate NASA-format PDF (NF■1676 ready).

Prepared by: Sam (MECSAI Engineering Node) Authorized by: ARCHITECT / ATB Board Status: Approved for Public Project Files