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Originating Organization: Spear Enterprise LLC / SDC & COMMS Program

Prepared By: ARCHITECT / MECHWORK / HYDRATEK / MECSAI

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Related Projects: SDC & COMMS / MECSAI / Unified Autonomous Architecture

Step	Role / Title	Name	Date	Signature
1	ARCHITECT (Project Director)			
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6	HFX (Human Factors Lead)			
7	STRUCT (Structural & Civil Lead)			
8	NASA Liaison (Partner Archive Manager)			
Final Approval	ATB Chair			

Abstract

This transmission formally submits the **SDC & COMMS Optical Communications White Paper v1.1 – NASA MCP Integrated Edition** for review and archival under ATB authority. The report unifies optical communication architecture, standards, and security across the SDC & COMMS program, consolidating data from the NASA MCP Crosswalk v0.1, MCP Agent Blueprint v0.1, ATB Laser Standards Report, MECSAI Optical Security Analysis, and the SDC Master Plan v1.1. It defines compliance with CCSDS 141/142 Blue Books, SDA OCT/OISL standards, and the NASA LCRNS alignment matrix, and includes annexes A–E covering optical link budgets, PAT logic, OGS models, QKD interfaces, and routing forms.

Action Requested

1. Initiate ATB Quality-First Gate Review per NASA-STD-7009.
2. Record document in ATB Registry as ATB-2025-10-SDC-OPTICAL-WP-01.
3. Transmit digital copy to NASA Liaison for partner archival under LCRNS integration.
4. Return signed routing form to ARCHITECT within the current reporting cycle.

Prepared For: Advanced Tech Board (ATB) / NASA Partner Liaison

Prepared By: Spear Enterprise LLC – SDC & COMMS Program

Status: Ready for Distribution — Internal Use Only

SDC & COMMS Optical Communications White Paper

v1.1

NASA MCP Integrated Edition

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This document integrates the MCP crosswalk, ATB Laser Standards, MECSAI security framework, and SDC Master Plan into a unified NASA-standard report on optical communications design, compliance, and operational readiness. It serves as the definitive internal submission to the ATB board for archival under NASA-STD-7009 protocols.

1. Executive Summary

Integration of AfSA–Oxford–ESA course insights and SDC Master Plan architecture for GEO–LEO optical mesh design.

2. NASA MCP Alignment Matrix

Crosswalk mapping LNIS, ICSIS, SCaN-MOCS, and LCRNS specifications to subsystem readiness states.

3. Optical System Architecture

GEO–LEO topology with adaptive PAT logic, DTN BPv7 routing, and AFS time distribution.

4. Security Architecture

MECSAI multi-layer optical data security stack, quantum-resistant encryption, and zero-trust orchestration.

5. Standards and Compliance Crosswalk

MCP Agent Blueprint v0.1 alignment and Change Detection Playbook automation.

6. Integration with MECSAI & Agent Swarm

Autonomous routing, audit traceability, and ATB quality gates.

7. Financial and Operational Readiness

Derived from SDC Constellation v1.0 and Master Plan v1.1 financial annexes.

8. Recommendations & Roadmap

Implementation phases for ATB and NASA compliance testing.

9. Conclusions and Action Items

Finalize ATB approval cycle; schedule LCRNS optical acquisition trials.

Embedded Annexes

Annex A — Optical Link Budget Model Annex B — PAT Control Logic Diagram Annex C — OGS Site Map and Availability Model Annex D — QKD Interface Overview Annex E — NASA Form 1686 Routing Slip