NASA MCP Crosswalk v0.1
(LNIS v5, ICSIS Rev B, SCaN-MOCS, LCRNS) → SDC & COMMS Alignment

#1) Purpose
Clause-by-clause mapping between NASA/partner interoperability baselines and our SDC & COMMS subsystems to assess alignment, gaps, and actions.

#2) Subsystems Covered
- Optical Mesh Router (OMR)
- Relay Node Controller (RNC)
- Ground Station Interface (GSI)
- DTN Core (BPv7/CSP, custody, convergence layers)
- PNT/Timing (AFS, time distribution, time-tagging)

#3) RAG Scale
- ■ Aligned: Complies as designed or trivially verifiable
- ■■ Partial: Needs test or minor interface work
- ■ Gap: Non-compliant or TBD design element

#4) Crosswalk Matrix (excerpt v0.1)
Spec	Section	Requirement Theme	Subsystem(s)	Alignment	Notes / Actions
LNIS v5	§5.2.4 Optical Links & Routing	Adaptive optical link, reroute on fade; LNSP service interface	OMR, RNC	■■	Verify LNSP handshake timing and failure modes under eclipse/plume; add telemetry hooks for link-state QoS
LNIS v5	§7.3 DTN Usage	BPv7 support, custody transfer, bundle security	DTN Core	■	Confirm convergence-layer parameters for optical/RF dual-homing; include priority classes
LNIS v5	§8 PNT & AFS	Time transfer accuracy and AFS reception paths	PNT/Timing	■	Add AFS downlink receiver plan; define PPS distribution and holdover disciplining
ICSIS Rev B	§4.6 Interoperable Relay Interface	Multi-provider relay service semantics	OMR, RNC, GSI	■■	Map relay service catalog to routing policy; validate cross-provider session continuity
ICSIS Rev B	§5.4 Timing & Messaging	Cross-agency timing integrity and message formats	PNT/Timing, DTN Core	■■	Add timing sanity checks in DTN node; log skew and drift metrics to MECSAI
SCaN-MOCS	§3 Service Tiers	Ground scheduling, service-level definitions	GSI	■■	Implement service-tier negotiation; add outage/scheduling events into ops timeline
SCaN-MOCS	§5 Spectrum Mgmt Refs	Frequency coordination & policy refs	OMR, GSI	■	Create spectrum policy artifact links; add band-plan validation to preflight checks
LCRNS	Testbed Validation	Interop validation targets for LunaNet	OMR, RNC, PNT	■■	Plan remote test sessions; prepare KPIs for optical acquisition time, DTN custody success
LCRNS	Nav/Time Services	LANS/AFS broadcast expectations	PNT/Timing	■	Prototype AFS receiver emulation; verify time-tag precision across hops

> Full clause mapping will be expanded to include clause IDs and exact citations in v0.2.

#5) Derived Engineering Actions
1. **LNSP Timing Harness**: add synthetic fade/eclipse scenarios, measure handshake retries, and DTN re-route latency.
2. **Dual-Homing Policy**: codify RF fallback thresholds and hysteresis; expose to MECSAI.
3. **AFS Integration Plan**: component selection, antenna/optics path, and PPS/10 MHz distribution in OMR/RNC cabinets.
4. **Ground Tier Negotiation**: implement SCaN service-tier descriptors; schedule-aware routing.
5. **Spectrum Checklist**: band-plan JSON; preflight validator; storage of coordination artifacts in MCP.
6. **LCRNS Readiness**: KPI pack: PAT time, closed-loop tracking stability, DTN custody success rate, time-tag RMS.

#6) Data Products
- Crosswalk JSON (machine-readable)
- RAG Dashboard for MECSAI
- ICD Reference Pack (clause excerpts with IDs)

#7) Next Steps
- Expand matrix to full clause coverage
- Import baseline citations and SHA checksums
- Run first alignment audit on Optical Mesh Router