

FULL SPECTRUM SPACE CYBERSECURITY PROFESSIONAL

REFERENCE WORKBOOK

Kestrel Orbital Day-1 CONOPS

The Enumerated Taxonomic Element Nomenclature (ETEN) reference.
44 enumerated elements across four structural layers,
each carrying its per-instance description.

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SCOPE AND STANDING OF THIS WORK · READ BEFORE JUDGING THE ENUMERATION

What this is. Kestrel Orbital's first application of the METEORSTORM framework, produced by three departments who had never used it before, in five working days. It is a deliberately scoped first pass over the telecommand path: the command-and-control chain from the operator console to execution on orbit.

Why that scope, and not more. The mandates chose it. Executive Order 14144 puts the command and control of an operational platform first, and the NIS2 Directive places a duty of care and a reporting clock on the ground operator. The fleet is already flying, so the first pass ran on the part that would end the mission if an adversary took it. Enumerating everything else first would have been thorough and useless.

What it is not, stated plainly. It is not an exhaustive model of the platform and does not claim to be. Elements off the telecommand path are not enumerated. Some assets group several physical units where those units share an owner, a build and a patch path. Gaps in the ordinal sequence mark elements the register tracks outside this scope. Every one of those is a recorded decision taken at the enumeration meeting, not an oversight discovered later.

How it grows. Ordinals are issued once and never renumbered, so everything enumerated here keeps its identifier as the register expands. The same eight-step procedure runs on the next scope, and the one after that. A first pass that names its boundary can be extended. One that hides its boundary has to be rebuilt.

The standard we hold ourselves to. A scope choice is stated openly. A defect is fixed, never narrated. If you find an element misnamed, a parent wrong, or a count that does not add up, that is a defect and we want to hear about it. If you find something outside the telecommand path missing, that is the scope, it was chosen deliberately, and it is on the roadmap. The two are not the same criticism, and this work is built so you can tell them apart.

CONTENTS

01 Introduction 5

02 The Kestrel Enumeration 7

03 L1 PCE · Environments (4) 9

04 L2 SEG · Segments (4) 12

05 L3 SVC · Services (15) 15

06 L4 AST · Assets (21) 23

INTRODUCTION

An Enumerated Taxonomic Element Nomenclature (ETEN) names one real element on a platform, in five fields.

ETEN EXAMPLE

LAYER	PCE
TAG	TE
LABEL	Terrestrial
ORDINAL	00
DESCRIPTION	Reston, Virginia land site hosting the primary mission-operations complex, its control facilities, and the network operations center.

The enumeration that produces every ETEN is governed by the normative process: the scope bounds what is enumerated, the taxonomy supplies the tag and label, the ontology links the parent, and the description states the instance.

ETEN PROCESS

- STEP 01** **Set the scope**, from the resilience objective and the requirements that drive the decomposition; an element outside the scope is not enumerated. Kestrel's scope is the telecommand path.
- STEP 02** **Select the layer**, working top down through the taxonomy's structural layers, and confirm the element passes that layer's definition gate before proceeding. The gates are the taxonomy's layer definitions, verbatim:
- PCE** **Primary Capability Environment**. "Operational zone in which a capability primarily exists or is exercised." The gate: you are naming a WHERE, a zone, not a thing in it.
- SEG** **Segment**. "Service and asset enclaves that compose the system across environments." The gate: you are naming an ENCLAVE, a grouping of services and assets, not the zone it sits in and not the hardware inside it.
- SVC** **Service**. "Functional planes that organize control and data responsibilities." The gate: you are naming a functional RESPONSIBILITY, what the platform does, not what it is built from.
- AST** **Asset**. "Asset classes composing the system and its interfaces." The gate: you are naming a CONCRETE ELEMENT, a real component the platform is built from.
- Tiebreak for the recurring trap: PCE and SEG share tag names (Orbital and Space, Aquatic, Deep Space) but are different things. Ask: am I naming a zone, or a group of services and assets? Zone means PCE; group means SEG. An element that fails its layer's gate is not enumerated at that layer; reclassify and re-enter at Step 02. Enrichment (AN) follows in Functions 02 through 05.
- STEP 03** **Select the tag** from the taxonomy for that layer; never invent one.
- STEP 04** **Write the label** exactly as the taxonomy publishes it for that tag.
- STEP 05** **Assign the ordinal**, two digits from 00, counted per tag.
- STEP 06** **Link the parent** one layer up. This link is the ontology: every child names its parent, PCE is the root, and no element is an orphan. The parent chain enforces the layer gates structurally: a segment names one or more environments, a service names one or more segments, and an asset names one or more services, never zero. An enrichment element takes no parent; it anchors through its target field.
- STEP 07** **Set the optional fields**: a service marks DISTRIBUTED when it spans more than one segment; an asset may carry a SUBSYSTEM grouping; an enrichment element carries its TARGET and SOURCE.
- STEP 08** **Write the description**, one plain sentence stating what this exact instance is on this platform, at its own layer: a zone for an environment, an enclave of services and assets for a segment, a responsibility for a service, a concrete element for an asset. The layer gate from Step 02 applies again here: a segment description never describes the hardware inside the enclave; a service description begins "The service that ..."; an asset description begins with its element class ("The physical ...", "The embedded ...", "The flight software ...", "The stored ...", "The transmitted ..."). An instance described at the wrong layer is non-compliant.

THE KESTREL ENUMERATION

You had eight hours with the Security Operations Center, Satellite Operations Center, and Satellite Design & Engineering. The scope came first, under Function 01, Concept of Operations: the telecommand path, the command-and-control scope Executive Order 14144 and the NIS2 Directive hold Kestrel to.

Eight hours across three departments does not exhaust a platform, and this enumeration is not exhaustive. It is enough: 44 elements that demonstrate to management that the three departments decompose one platform against one taxonomy, one ontology, and one process. The Day-1 CONOPS below is the result.

The collaboration of your local team or teams is vital: it is what lets you adopt the Resilient Cyber Operations framework in the way that works best for you. Adoption is also the essence of space collective defense: every organization that enumerates against the same taxonomy and ontology can exchange enrichment machine to machine, and each new adopter makes that exchange easier. The machine-readable releases under Downloads exist for that purpose.

Why two orbital environments but one space inventory: the teams enumerated PCE:0R:Orbital:00 (GEO) and PCE:0R:Orbital:01 (MEO) separately, because regime-specific enrichment (space weather, contact geometry, radiation) attaches at the environment layer. They ruled one Space segment with one shared set of services and assets across both regimes, sized to the current workload: the fleet flies as one commanded constellation through one telecommand path, and splitting every flight service per regime would have roughly doubled the space-segment inventory before anyone knew whether the split earned its keep. The plan of record is to track the SDA (space domain awareness) to measure how much operational activity is specific to MEO versus GEO, then use that evidence to build the longer-term plan for coordinating enumeration of the entire platform.

4 environments · 4 segments · 15 services · 21 assets = 44 elements. Scope: the telecommand path, a first pass.

Why these share a band. First pass: 2 orbit regimes enumerated, one set of services enumerated to cover them all. The rest follow the same procedure when their turn comes.



L1 PCE · ENVIRONMENTS (4)

PCE KEY POINTS

KEY POINT

What was missing: security frameworks carried no taxonomy and no ontology for the environment; where a platform operates was prose context, not an element that threats, detections, and resilience measures could anchor to.

Recommendation: enumerate every distinct operational zone as its own PCE, one per physical site; a new site is a new ordinal, no restructuring.

Kestrel: `PCE:TE:Terrestrial:00` Reston, Virginia and `PCE:TE:Terrestrial:01` Kiruna, Sweden, so enrichment lands at the location level (terrestrial weather over the site, possible positioning of mobile electronic-warfare apparatus near it) while the set of environments preserves the global view.

KEY POINT

What was missing: aerial, aquatic, orbital, and deep space were one undifferentiated environment, so there was no way to enrich by taxonomy and ontology for space domain awareness.

Recommendation: one PCE per orbital regime, never a generic orbital; the taxonomy already carries Terrestrial, Aquatic, Aerial, Orbital, and Deep Space, so the model extends without change.

Kestrel: the fleet spans two regimes, so it carries two orbital environments,

`PCE:OR:Orbital:00` GEO and `PCE:OR:Orbital:01` MEO, aligning space-weather enumeration to each regime.

KEY POINT

What was missing: a rule for whether a fleet spanning two regimes needs its inventory split per regime or shared across them.

Recommendation: enumerate the environments separately, share one segment and one service and asset set while the workload supports it, and let evidence, not habit, decide a future split.

Kestrel: two orbital environments, one Space segment: one shared service and asset set sized to current workload; the teams track the SDA (space domain awareness) to measure what is MEO-specific versus GEO-specific, then build the longer-term plan to coordinate enumerating the entire platform.

PCE ORBITAL · ORDINAL 00

ETEN NOMENCLATURE

PCE:OR:Orbital:00:The geostationary orbit regime (~35,786 km) part of the fleet flies in, fixing its coverage geometry, contact windows, and radiation exposure.

LAYER	PCE Primary Capability Environment (L1)
TAG	OR
LABEL	Orbital
ORDINAL	00
PARENT	none, root element
DESCRIPTION	The geostationary orbit regime (~35,786 km) part of the fleet flies in, fixing its coverage geometry, contact windows, and radiation exposure.

PCE ORBITAL · ORDINAL 01

ETEN NOMENCLATURE

PCE:OR:Orbital:01:The medium Earth orbit regime (~8,000 km) part of the fleet flies in, with its own orbital periods, contact windows, and radiation environment.

LAYER	PCE Primary Capability Environment (L1)
TAG	OR
LABEL	Orbital
ORDINAL	01
PARENT	none, root element
DESCRIPTION	The medium Earth orbit regime (~8,000 km) part of the fleet flies in, with its own orbital periods, contact windows, and radiation environment.

PCE TERRESTRIAL · ORDINAL 00

ETEN NOMENCLATURE

PCE:TE:Terrestrial:00:Reston, Virginia land site hosting the primary mission-operations complex, its control facilities, and the network operations center.

LAYER	PCE Primary Capability Environment (L1)
TAG	TE
LABEL	Terrestrial
ORDINAL	00
PARENT	none, root element
DESCRIPTION	Reston, Virginia land site hosting the primary mission-operations complex, its control facilities, and the network operations center.

PCE TERRESTRIAL · ORDINAL 01

ETEN NOMENCLATURE

PCE:TE:Terrestrial:01:Kiruna, Sweden polar TT&C ground-station site (67.9°N) that carries the command path into the link; a separate site with its own ordinal for clean failover and jurisdiction analysis.

LAYER	PCE Primary Capability Environment (L1)
TAG	TE
LABEL	Terrestrial
ORDINAL	01
PARENT	none, root element
DESCRIPTION	Kiruna, Sweden polar TT&C ground-station site (67.9°N) that carries the command path into the link; a separate site with its own ordinal for clean failover and jurisdiction analysis.

L2 SEG · SEGMENTS (4)

SEG KEY POINTS

KEY POINT	What was missing: enterprise models carried no enclave that spans environments, so jurisdiction and failover lived outside the model. Recommendation: one segment per enclave of services and assets; each physically or jurisdictionally distinct enclave takes its own ordinal, and a cross-environment segment names every parent. Kestrel: <code>SEG:GR:Ground:00</code> Reston, Virginia under US authorities, <code>SEG:GR:Ground:01</code> Kiruna under Sweden and the EU, and the Link naming both the Orbital and Terrestrial environments.
KEY POINT	What was missing: models described the enterprise a company has today, so growth broke them. Recommendation: the segment taxonomy already carries Launch, Link, Ground, User, Aquatic, Low Altitude, High Altitude, Near Space, Space, and Deep Space, so Resilient Cyber Operations is future proof by construction: a merger, an acquisition, or a new market enumerates into existing tags with new ordinals, never a remodel. Kestrel: a downrange tracking ship enumerates as <code>SEG:AQ:Aquatic:00</code>, a stratospheric relay as <code>SEG:NE:Near Space:00</code>, and a cis-lunar mission as <code>SEG:DE:Deep Space:00</code>, the day the business needs them.

SEG SPACE · ORDINAL 00

ETEN NOMENCLATURE

SEG:SP:Space:00:The on-orbit enclave: the flight services and their assets operating on the constellation spacecraft, beyond physical reach.

LAYER	SEG Segment (L2)
TAG	SP
LABEL	Space
ORDINAL	00
PARENT	PCE:OR:Orbital:00 + PCE:OR:Orbital:01
DESCRIPTION	The on-orbit enclave: the flight services and their assets operating on the constellation spacecraft, beyond physical reach.

SEG LINK · ORDINAL 00

ETEN NOMENCLATURE

SEG:LI:Link:00:The link enclave: the services and assets carrying telecommand up and telemetry and mission data down across the RF and optical signal path between space and ground.

LAYER	SEG Segment (L2)
TAG	LI
LABEL	Link
ORDINAL	00
PARENT	PCE:OR:Orbital:00 + PCE:OR:Orbital:01 + PCE:TE:Terrestrial:00
DESCRIPTION	The link enclave: the services and assets carrying telecommand up and telemetry and mission data down across the RF and optical signal path between space and ground.

SEG GROUND · ORDINAL 00

ETEN NOMENCLATURE

SEG:GR:Ground:00:The Reston, Virginia mission-operations enclave: the control, crypto, access-control, patch, and console services that command the constellation.

LAYER	SEG Segment (L2)
TAG	GR
LABEL	Ground
ORDINAL	00
PARENT	PCE:TE:Terrestrial:00 + PCE:TE:Terrestrial:01
DESCRIPTION	The Reston, Virginia mission-operations enclave: the control, crypto, access-control, patch, and console services that command the constellation.

SEG **GROUND** · ORDINAL 01

ETEN NOMENCLATURE

SEG:GR:Ground:01:Kiruna, Sweden polar TT&C ground-station enclave; the second terrestrial ground segment, distinct from Reston, hosting the site RF ground terminal.

LAYER	SEG Segment (L2)
TAG	GR
LABEL	Ground
ORDINAL	01
PARENT	PCE:TE:Terrestrial:01
DESCRIPTION	Kiruna, Sweden polar TT&C ground-station enclave; the second terrestrial ground segment, distinct from Reston, hosting the site RF ground terminal.

L3 SVC · SERVICES (15)**SVC KEY POINTS**

KEY POINT **What was missing:** no plane-level taxonomy: command and mission traffic blurred together, and a cross-segment service was filed in one box, hiding the surface an adversary crosses.

Recommendation: classify every service by what actually flows through it, Control Plane, Data Plane, or Hybrid when both, and mark DISTRIBUTED with every parent segment named.

Kestrel: SVC:HY:Hybrid:00 C&DH carries commands and mission data, so it is Hybrid by classification, not by guess.

SPACE SEGMENT SERVICES · PARENT SEG:SP:SPACE:00**SVC CONTROL PLANE · ORDINAL 00**

ETEN NOMENCLATURE

SVC:CP:Control Plane:00:The service that determines and controls spacecraft orientation (ADCS).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	00
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that determines and controls spacecraft orientation (ADCS).

SVC HYBRID · ORDINAL 00

ETEN NOMENCLATURE

SVC:HY:Hybrid:00:The service that executes commands and moves data across the vehicle, on both the control and data planes (C&DH).

LAYER	SVC Service (L3)
TAG	HY
LABEL	Hybrid
ORDINAL	00
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that executes commands and moves data across the vehicle, on both the control and data planes (C&DH).

SVC DATA PLANE · ORDINAL 00

ETEN NOMENCLATURE

SVC:DP:Data Plane:00:The service that carries telemetry and payload product to the ground (Comms).

LAYER	SVC Service (L3)
TAG	DP
LABEL	Data Plane
ORDINAL	00
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that carries telemetry and payload product to the ground (Comms).

SVC CONTROL PLANE · ORDINAL 01

ETEN NOMENCLATURE

SVC:CP:Control Plane:01:The service that encrypts and authenticates on board, including telecommand authentication (Crypto, space).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	01
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that encrypts and authenticates on board, including telecommand authentication (Crypto, space).

SVC CONTROL PLANE · ORDINAL 02

ETEN NOMENCLATURE

SVC:CP:Control Plane:02:The service that generates, stores, and distributes electrical power (EPS).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	02
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that generates, stores, and distributes electrical power (EPS).

SVC CONTROL PLANE · ORDINAL 04

ETEN NOMENCLATURE

SVC:CP:Control Plane:04:The service that holds every component within its temperature limits (TCS).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	04
PARENT	SEG:SP:Space:00
DESCRIPTION	The service that holds every component within its temperature limits (TCS).

LINK SEGMENT SERVICES · PARENT SEG:LI:LINK:00

SVC CONTROL PLANE · ORDINAL 05

ETEN NOMENCLATURE

SVC:CP:Control Plane:05:The service that authenticates command sources and enforces command acceptance on the uplink (ACA, link).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	05
PARENT	SEG:LI:Link:00
DESCRIPTION	The service that authenticates command sources and enforces command acceptance on the uplink (ACA, link).

SVC HYBRID · ORDINAL 01

ETEN NOMENCLATURE

SVC:HY:Hybrid:01:The service that detects or corrects bit errors on the link (FEC/ECC error handling).

LAYER	SVC Service (L3)
TAG	HY
LABEL	Hybrid
ORDINAL	01
PARENT	SEG:LI:Link:00
DESCRIPTION	The service that detects or corrects bit errors on the link (FEC/ECC error handling).

SVC CONTROL PLANE · ORDINAL 06

ETEN NOMENCLATURE

SVC:CP:Control Plane:06:The service that detects hostile command or state manipulation on board and recovers from it.

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	06
PARENT	SEG:LI:Link:00
DESCRIPTION	The service that detects hostile command or state manipulation on board and recovers from it.

SVC HYBRID · ORDINAL 02

ETEN NOMENCLATURE

SVC:HY:Hybrid:02:The service that tracks the vehicle and returns telemetry across the control loop and the data path (T2).

LAYER	SVC Service (L3)
TAG	HY
LABEL	Hybrid
ORDINAL	02
PARENT	SEG:LI:Link:00
DESCRIPTION	The service that tracks the vehicle and returns telemetry across the control loop and the data path (T2).

GROUND SEGMENT SERVICES (RESTON) · PARENT SEG:GR:GROUND:00

SVC CONTROL PLANE · ORDINAL 08

ETEN NOMENCLATURE

SVC:CP:Control Plane:08:The service that protects commands before uplink and data after downlink (Crypto, ground).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	08
PARENT	SEG:GR:Ground:00
DESCRIPTION	The service that protects commands before uplink and data after downlink (Crypto, ground).

SVC CONTROL PLANE · ORDINAL 09

ETEN NOMENCLATURE

SVC:CP:Control Plane:09:The service that decides who may command and which commands are released to the link (ACA, ground).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	09
PARENT	SEG:GR:Ground:00
DESCRIPTION	The service that decides who may command and which commands are released to the link (ACA, ground).

SVC CONTROL PLANE · ORDINAL 12

ETEN NOMENCLATURE

SVC:CP:Control Plane:12:The service that delivers and installs software and firmware updates under control (Patch Updates).

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	12
PARENT	SEG:GR:Ground:00
DESCRIPTION	The service that delivers and installs software and firmware updates under control (Patch Updates).

SVC CONTROL PLANE · ORDINAL 13

ETEN NOMENCLATURE

SVC:CP:Control Plane:13:The service that gives operators the mission-ops console: telemetry monitoring and command issue.

LAYER	SVC Service (L3)
TAG	CP
LABEL	Control Plane
ORDINAL	13
PARENT	SEG:GR:Ground:00
DESCRIPTION	The service that gives operators the mission-ops console: telemetry monitoring and command issue.

GROUND SEGMENT SERVICES (KIRUNA) · PARENT SEG:GR:GROUND:01

SVC **HYBRID** · ORDINAL 03

ETEN NOMENCLATURE

SVC:HY:Hybrid:03:The service that transmits the command uplink and receives the downlink at the Kiruna ground station (RF ground terminal).

LAYER	SVC Service (L3)
TAG	HY
LABEL	Hybrid
ORDINAL	03
PARENT	SEG:GR:Ground:01
DESCRIPTION	The service that transmits the command uplink and receives the downlink at the Kiruna ground station (RF ground terminal).

L4 AST · ASSETS (21)

AST KEY POINTS

KEY POINT **What was missing:** asset inventories stopped at "the satellite" or "the ground system," and a bundle cannot carry a threat anchor.

Recommendation: one asset per concrete element under exactly one parent service, split to the depth you defend; a new asset slots under its service without renumbering.

Kestrel: `AST:SI:Signal:00` the TC uplink waveform, `AST:DA:Data:03` the on-board key store, and `AST:FW:Firmware:01` the OBC boot firmware are separate elements, so a threat anchors to the exact asset it exploits, never a bundle.

SPACE SEGMENT ASSETS · EACH PARENTS TO A SERVICE WITHIN `SEG:SP:SPACE:00`

AST HARDWARE · ORDINAL 00

ETEN NOMENCLATURE

`AST:HW:Hardware:00:The physical attitude sensors: star trackers, sun sensors, gyros, magnetometers.`

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	00
PARENT	SVC:CP:Control Plane:00
DESCRIPTION	The physical attitude sensors: star trackers, sun sensors, gyros, magnetometers.

AST SOFTWARE · ORDINAL 00

ETEN NOMENCLATURE

`AST:SW:Software:00:The flight software that runs the ADCS control algorithms.`

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	00
PARENT	SVC:CP:Control Plane:00
DESCRIPTION	The flight software that runs the ADCS control algorithms.

AST **HARDWARE** · ORDINAL 01

ETEN NOMENCLATURE

AST:HW:Hardware:01:The physical power chain: solar arrays, batteries, power distribution.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	01
PARENT	SVC:CP:Control Plane:02
DESCRIPTION	The physical power chain: solar arrays, batteries, power distribution.

AST **HARDWARE** · ORDINAL 03

ETEN NOMENCLATURE

AST:HW:Hardware:03:The physical thermal hardware: heaters, radiators, coatings, insulation.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	03
PARENT	SVC:CP:Control Plane:04
DESCRIPTION	The physical thermal hardware: heaters, radiators, coatings, insulation.

AST **HARDWARE** · ORDINAL 06

ETEN NOMENCLATURE

AST:HW:Hardware:06:The physical on-board computer and OBDH bus on each constellation spacecraft.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	06
PARENT	SVC:HY:Hybrid:00
DESCRIPTION	The physical on-board computer and OBDH bus on each constellation spacecraft.

AST **FIRMWARE** · ORDINAL 01

ETEN NOMENCLATURE

AST:FW:Firmware:01:The embedded OBC boot firmware, the root of trust that runs first at power-on.

LAYER	AST Asset (L4)
TAG	FW
LABEL	Firmware
ORDINAL	01
PARENT	SVC:HY:Hybrid:00
DESCRIPTION	The embedded OBC boot firmware, the root of trust that runs first at power-on.

AST **SOFTWARE** · ORDINAL 06

ETEN NOMENCLATURE

AST:SW:Software:06:The flight software that executes commands and runs FDIR for C&DH.

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	06
PARENT	SVC:HY:Hybrid:00
DESCRIPTION	The flight software that executes commands and runs FDIR for C&DH.

AST **FIRMWARE** · ORDINAL 02

ETEN NOMENCLATURE

AST:FW:Firmware:02:The embedded repeater firmware that governs receive, process, and retransmit on the link.

LAYER	AST Asset (L4)
TAG	FW
LABEL	Firmware
ORDINAL	02
PARENT	SVC:DP:Data Plane:00
DESCRIPTION	The embedded repeater firmware that governs receive, process, and retransmit on the link.

AST **DATA** · ORDINAL 03

ETEN NOMENCLATURE

AST:DA:Data:03:The stored flight keys and certificates the space cryptographic service encrypts and authenticates with.

LAYER	AST Asset (L4)
TAG	DA
LABEL	Data
ORDINAL	03
PARENT	SVC:CP:Control Plane:01
REFERENCE	CCSDS 355.0-B (SDLS); CCSDS 357.0-B; NIST SP 800-57
DESCRIPTION	The stored flight keys and certificates the space cryptographic service encrypts and authenticates with.

LINK SEGMENT ASSETS · EACH PARENTS TO A SERVICE WITHIN SEG:LI:LINK:00

AST **SIGNAL** · ORDINAL 00

ETEN NOMENCLATURE

AST:SI:Signal:00:The transmitted telecommand uplink waveform that carries commands from ground to spacecraft.

LAYER	AST Asset (L4)
TAG	SI
LABEL	Signal
ORDINAL	00
PARENT	SVC:HY:Hybrid:01
DESCRIPTION	The transmitted telecommand uplink waveform that carries commands from ground to spacecraft.

AST **DATA** · ORDINAL 00

ETEN NOMENCLATURE

AST:DA:Data:00:The stored link ACA credentials the access-control service checks.

LAYER	AST Asset (L4)
TAG	DA
LABEL	Data
ORDINAL	00
PARENT	SVC:CP:Control Plane:05
DESCRIPTION	The stored link ACA credentials the access-control service checks.

AST SOFTWARE · ORDINAL 05

ETEN NOMENCLATURE

AST:SW:Software:05:The flight software that detects hostile command or state manipulation in flight and recovers.

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	05
PARENT	SVC:CP:Control Plane:06
REFERENCE	NIST IR 8270; Falco et al. 2024
DESCRIPTION	The flight software that detects hostile command or state manipulation in flight and recovers.

AST SIGNAL · ORDINAL 01

ETEN NOMENCLATURE

AST:SI:Signal:01:The transmitted telemetry and ranging waveform: the modulated downlink signal, its framing, coding, and ranging tones.

LAYER	AST Asset (L4)
TAG	SI
LABEL	Signal
ORDINAL	01
PARENT	SVC:HY:Hybrid:02
REFERENCE	CCSDS 132.0-B (TM Space Data Link); CCSDS TT&C
DESCRIPTION	The transmitted telemetry and ranging waveform: the modulated downlink signal, its framing, coding, and ranging tones.

**GROUND SEGMENT ASSETS (RESTON) · EACH PARENTS TO A SERVICE WITHIN
SEG:GR:GROUND:00****AST SOFTWARE · ORDINAL 02**

ETEN NOMENCLATURE

AST:SW:Software:02:The ground software that enforces command acceptance before release to the link (ACA).

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	02
PARENT	SVC:CP:Control Plane:09
DESCRIPTION	The ground software that enforces command acceptance before release to the link (ACA).

AST DATA · ORDINAL 01

ETEN NOMENCLATURE

AST:DA:Data:01:The stored ACA credentials the ground authentication service relies on.

LAYER	AST Asset (L4)
TAG	DA
LABEL	Data
ORDINAL	01
PARENT	SVC:CP:Control Plane:09
DESCRIPTION	The stored ACA credentials the ground authentication service relies on.

AST DATA · ORDINAL 02

ETEN NOMENCLATURE

AST:DA:Data:02:The stored patch binaries, firmware and software, staged for deployment.

LAYER	AST Asset (L4)
TAG	DA
LABEL	Data
ORDINAL	02
PARENT	SVC:CP:Control Plane:12
DESCRIPTION	The stored patch binaries, firmware and software, staged for deployment.

AST SOFTWARE · ORDINAL 03

ETEN NOMENCLATURE

AST:SW:Software:03:The software pipeline that builds, signs, distributes, and installs patches.

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	03
PARENT	SVC:CP:Control Plane:12
DESCRIPTION	The software pipeline that builds, signs, distributes, and installs patches.

AST **HARDWARE** · ORDINAL 04

ETEN NOMENCLATURE

AST:HW:Hardware:04:The physical operator workstation from which telemetry is monitored and commands are issued.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	04
PARENT	SVC:CP:Control Plane:13
DESCRIPTION	The physical operator workstation from which telemetry is monitored and commands are issued.

AST **SOFTWARE** · ORDINAL 04

ETEN NOMENCLATURE

AST:SW:Software:04:The software C2 application on the operator console, the ground command-and-control suite.

LAYER	AST Asset (L4)
TAG	SW
LABEL	Software
ORDINAL	04
PARENT	SVC:CP:Control Plane:13
DESCRIPTION	The software C2 application on the operator console, the ground command-and-control suite.

AST **HARDWARE** · ORDINAL 05

ETEN NOMENCLATURE

AST:HW:Hardware:05:The physical ground cryptographic module (HSM) that stores ground keys and performs encryption, decryption, signing, and verification.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	05
PARENT	SVC:CP:Control Plane:08
REFERENCE	CCSDS 355.0-B (SDLS); NIST SP 800-57
DESCRIPTION	The physical ground cryptographic module (HSM) that stores ground keys and performs encryption, decryption, signing, and verification.

**GROUND SEGMENT ASSETS (KIRUNA) · EACH PARENTS TO A SERVICE WITHIN
SEG:GR:GROUND:01****AST** **HARDWARE** · ORDINAL 08

ETEN NOMENCLATURE

AST:HW:Hardware:08:The physical Kiruna antenna, feed, and low-noise / high-power RF front end.

LAYER	AST Asset (L4)
TAG	HW
LABEL	Hardware
ORDINAL	08
PARENT	SVC:HY:Hybrid:03
REFERENCE	NIST IR 8401; CCSDS TT&C
DESCRIPTION	The physical Kiruna antenna, feed, and low-noise / high-power RF front end.