

Chapter 2 — Prerequisites and Core Concepts

Before diving into integration, it is essential to understand the foundational concepts and data structures that underpin the entire BR-UTM system. This chapter defines all key terms used throughout the integration guide.

2.1 DSS — Discovery and Synchronization Service

The **DSS** is the central coordination index of the BR-UTM ecosystem. It is operated by DECEA and is the single authoritative source for discovering what is happening in any given volume of airspace.

Critically, the DSS does not store the full details of any operation. It stores only *references* — lightweight records that tell other participants *who* is operating *where* and *when*, and *how to contact them* to get the full details. The actual volume geometry, flight profile, and telemetry are stored by each USS on their own systems and shared peer-to-peer on demand.

The DSS uses **Google S2 geometry cells** (approximately 1 km² each) to index airspace. Because S2 cells are rectangular approximations, the DSS may return references for operations that are geometrically close but do not precisely intersect with your query area. Your USS is responsible for performing the exact 4D intersection calculation locally.

The DSS is based on the [InterUSS Platform](#) open-source project, implementing ASTM F3548-21 and ASTM F3411-22A.

Base URL (Sandbox): `http://api.sandbox.brutm.dcta.mil.br/dss`

2.2 USS — UAS Service Supplier

A **USS** is a software system operated by a company that has been validated and authorized by DECEA to operate in the BR-UTM ecosystem. The USS is responsible for:

- Managing the full lifecycle of its customers' drone operations.
- Registering and coordinating those operations with the DSS.
- Communicating directly with other USSs (peer-to-peer) to share operational details.
- Exposing public HTTP endpoints that other USSs and DECEA can call.
- Monitoring drone telemetry and ensuring conformance with declared flight plans.

Every USS must have a publicly accessible base URL (e.g., `https://uss.yourcompany.com/utm`) registered in the DSS as part of every Operational Intent Reference it creates. This URL is used by other USSs and DECEA to contact your system directly.

2.3 OIR — Operational Intent Reference

An **Operational Intent Reference (OIR)** is a record stored in the DSS representing a company's *intention* to conduct a drone operation. It is the primary unit of coordination in the UTM system.

What the DSS stores about an OIR (the *Reference*):

- A unique entity ID (UUID)
- The managing USS identifier (`manager` — the JWT `sub` claim of the creating USS)
- The operational state (`Accepted`, `Activated`, `Nonconforming`, `Contingent`)
- The temporal window (`time_start`, `time_end`) and S2-indexed extents
- The USS's public base URL (`uss_base_url`) for peer-to-peer contact
- The current version number and **OVN (Object Version Number)**
- The subscription ID associated with this operation

What the USS stores about an OIR (the *Details*, not in DSS):

- The full 4D volumes (`volumes` — array of `Volume4D`)
- Off-nominal volumes (`off_nominal_volumes`) for emergency states
- Priority (currently always `0`)
- Flight type (`VLOS`, `EVLOS`, or `BVLOS`)

Other USSs retrieve these details by calling your USS directly at `GET /uss/v1/operational_intents/{entityid}`.

OIR States

State	Description
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Accepted	The flight plan has been created and registered in the DSS. Pre-flight planning phase. No drone is in the air yet.
Activated	The flight is actively underway. The drone is (or is about to be) airborne. Telemetry must be available.
Nonconforming	The drone has temporarily left its declared flight volume. The situation is considered recoverable. The OIR includes <code>off_nominal_volumes</code> . Can return to <code>Activated</code> .
Contingent	The drone has been outside its declared volume for more than 60 seconds. The situation is considered unrecoverable. Only <code>off_nominal_volumes</code> are active. Must eventually be closed.

2.4 OVN — Object Version Number

An **OVN (Object Version Number)** is an opaque token (string) that uniquely identifies the *current version* of a specific Operational Intent or Constraint in the DSS. It changes every time the entity is updated.

OVNs serve a critical purpose in the deconfliction protocol: **they are proof that you have seen and acknowledged the latest state of a neighboring operation or constraint**. Before you can create or update your own OIR, you must collect the OVNs of all nearby OIRs and Constraints (by fetching their details from the respective USSs) and include them in the `key` array of your DSS write request.

If you provide an outdated or missing OVN, the DSS will reject your request with a `409` `AirspaceConflictResponse`, listing the entities whose OVNs you are missing.

2.5 Subscription

A **Subscription** is a registration in the DSS that declares your USS's interest in a specific geographic area and time window. When any USS creates, updates, or deletes an OIR or Constraint that intersects your subscribed area, the DSS includes your USS in the `subscribers` list of its write response. The creating/updating USS then calls your USS at `POST /uss/v1/operational_intents` or `POST /uss/v1/constraints` to notify you.

There are two types of subscriptions:

- **Implicit (automatic):** When you create an OIR in the DSS, the DSS can automatically create a subscription for the same area and time window. You achieve this by providing a `new_subscription` object in your OIR creation request. This is the normal operational flow.

- **Explicit (manual):** You can create a standalone subscription using `PUT /dss/v1/subscriptions/{subscriptionid}`. This is useful for systems that need airspace awareness without having active operations — for example, a visualization or situational awareness tool.

2.6 ISA — Identification Service Area

An **ISA (Identification Service Area)** is a record stored in the **Remote ID DSS** (which shares the same DSS infrastructure) that indicates your USS is actively serving telemetry for a given geographic area during a given time window.

The ISA tells other systems (display providers, DECEA's monitoring tools) *where* your USS has active drone operations and *how to query* your telemetry endpoint (`/uss/flights`).

An ISA must be created **at the moment a flight is activated** (when the OIR transitions to `Activated`). It must be deleted when the flight ends and the OIR is deleted.

2.7 Volume4D — The 4D Airspace Volume

A **Volume4D** is the fundamental building block for describing airspace in BR-UTM. It combines a 3D geographic volume with a time window:

Component	Description
outline_polygon	A geographic polygon defined by a list of lat/lng vertices.
outline_circle	Alternatively, a circle defined by a center lat/lng and radius in meters.
altitude_lower	The floor altitude, in meters, WGS84 reference (<code>"W84"</code>).
altitude_upper	The ceiling altitude, in meters, WGS84 reference (<code>"W84"</code>).
time_start	Start of the time window, in RFC3339 format with UTC timezone (<code>Z</code>).
time_end	End of the time window, in RFC3339 format with UTC timezone (<code>Z</code>).

A single OIR can contain **multiple Volume4D objects** in its `volumes` array. This allows a complex operation (e.g., a vertical takeoff cylinder + a horizontal route polygon + a landing cylinder) to be described as a single coherent operational intent.

Example: A simple cylindrical volume

```
{
  "volume": {
    "outline_circle": {
      "center": { "lat": -23.2071, "lng": -45.8750 },
      "radius": { "value": 100, "units": "M" }
    },
    "altitude_lower": { "value": 0, "reference": "W84", "units": "M" },
    "altitude_upper": { "value": 120, "reference": "W84", "units": "M" }
  },
  "time_start": { "value": "2026-07-01T10:00:00Z", "format": "RFC3339" },
  "time_end": { "value": "2026-07-01T11:00:00Z", "format": "RFC3339" }
}
```

2.8 Constraint

A **Constraint** is a restriction on airspace usage, created and managed exclusively by DECEA (in Phase 1). Constraints represent no-fly zones, restricted areas, active ATM traffic zones, or reservations sourced from the DASA system (DECEA's airspace reservation tool).

From the USS's perspective, constraints are queried from the DSS just like OIRs. When a constraint exists in your area of interest, you must:

1. Retrieve its OVN from the DSS via `POST /dss/v1/constraint_references/query`.
2. Fetch its full volume details from DECEA's USS at `GET /uss/v1/constraints/{entityid}` (using the `uss_base_url` in the constraint reference).
3. Include its OVN in the `key` array of your OIR creation/update request.
4. Avoid creating operations that intersect active constraints.

Constraints arriving from DASA appear as regular `ConstraintReference` objects — your USS does not need to do anything special to handle them.

2.9 UTM Zone

A **UTM Zone** is a geographic allocation that a company creates in the Portal UTM to define the area where it intends to operate. It is defined by:

- A **geographic polygon** (the operational area)
- An **altitude range** (floor and ceiling)
- An optional **time validity** (can be permanent/indefinite)

All Operational Intents (OIRs) created by a company must be **strictly inside** their UTM Zone(s). A company can own multiple UTM Zones (e.g., for operations in different cities or regions). UTM Zones are permanently allocated — there is currently no renewal or expiration mechanism defined.

The UTM Zone is also the mechanism that links a validated software version (API Key) to a specific geographic area of operation. When a company registers a new UTM Zone using a valid API Key, DECEA can confirm that the company's software has been validated for operation in that area.

2.10 off_nominal_volumes

`off_nominal_volumes` is an array of `Volume4D` objects attached to an OIR that is in a `Nonconforming` or `Contingent` state. These volumes represent the **warning area** — the airspace that DECEA and neighboring USSs should treat as potentially hazardous due to the drone's deviation from its planned route.

- In **Nonconforming** state: both `volumes` (original plan) and `off_nominal_volumes` (warning area) are active.
- In **Contingent** state: only `off_nominal_volumes` are active — the original `volumes` are no longer relevant.

The size and shape of `off_nominal_volumes` is **entirely at the USS's discretion**, calculated based on the drone's current position, velocity, and the nature of the deviation. DECEA has not mandated a specific formula, but the off-nominal volumes should reasonably cover the route between the drone's actual position and the nearest point of the original volume.

2.11 Key Reference Summary

Term	Short Definition
DSS	Central coordination index for airspace. Stores only references.
USS	Your company's integrated software system. Manages flights, exposes APIs.

Term	Short Definition
OIR	An Operational Intent Reference — a flight plan registered in the DSS.
OVN	Object Version Number — proof you've seen the latest state of a neighbor entity.
Subscription	Registration of interest in an airspace area to receive notifications.
ISA	Identification Service Area — declares you're serving telemetry for an area.
Volume4D	3D polygon/circle + altitude range + time window.
Constraint	Airspace restriction created by DECEA. Must be respected by all USSs.
UTM Zone	Your company's authorized area of operation. OIRs must be inside it.
off_nominal_volumes	Warning area declared when a drone deviates from its planned volume.
manager	The JWT sub claim of the USS that created an OIR. Informational only.
uss_base_url	The public HTTPS base URL of your USS. Used for peer-to-peer calls and token audience.

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