AutarchFusion

Air picture: sensor acquisition and fusion

Many sensors, one air picture: plug in radars, networked sensors and cameras, and deliver one clean, numbered track per object to every console.

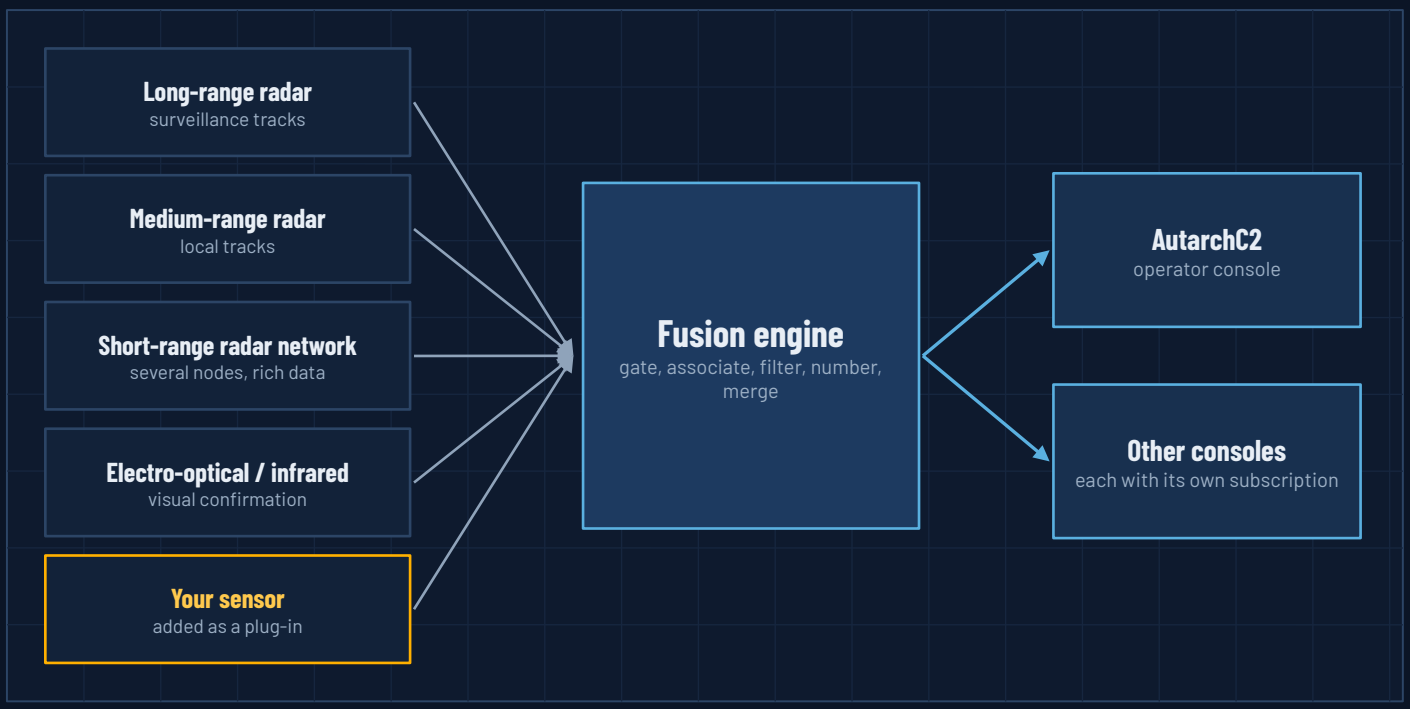


Illustration: sensor inputs feed one fusion engine, which streams one fused track per object to each subscribed console.

AutarchFusion (formerly AirPictureApp) separates sensor acquisition and fusion from command and control. Each sensor connects through its own input plug-in; the fusion engine associates the reports into one track per object, filters them into smooth, time-correct tracks with stable numbers, merges the extra data each sensor offers, and streams the resulting air picture to every subscribed console with the fields, update rate and area that console asks for.

STATUS

Validated in a full simulation environment, with AutarchTrackSim generating the radar, networked-sensor and camera feeds. No fielded use is claimed.

Plug-in sensors

New sensors added without changing the engine.

Robust association

Gated, sticky, nearest-neighbour association.

Smooth tracks

Filtering weighted by each sensor's accuracy.

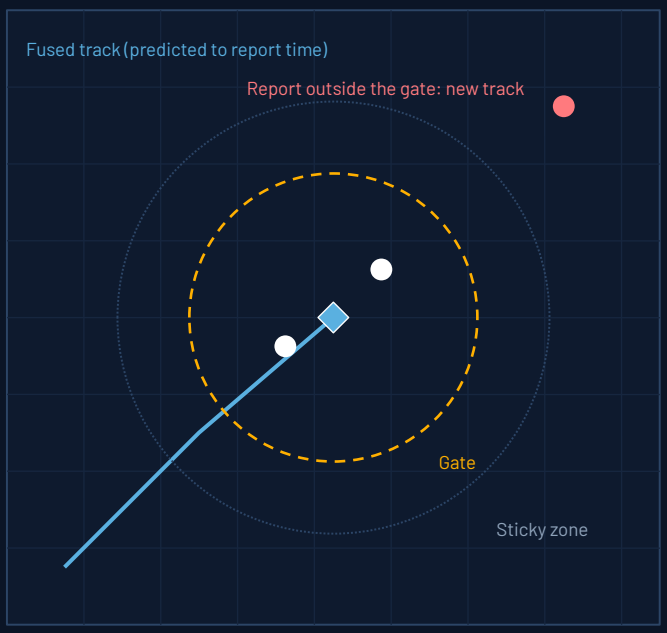
Tailored delivery

Each console chooses fields, rate and area.

HOW FUSION WORKS

From many reports to one track per object

Receive each sensor on its own input → **Time-align** sensor time, late reports handled → **Gate** distance and altitude window → **Associate** sticky, nearest neighbour → **Filter** smooth position and velocity → **Number and merge** stable numbers, rich data → **Deliver** per-console subscription



Two sensors' reports inside the gate update the same fused track; a report outside starts a new one.

Time-correct
Every report is placed at the time the sensor measured it, not when it arrived. A slightly late report is moved to the track's time; much older reports do not move the track.

Gated association
Each fused track is predicted to the time of a new report. The report is accepted if it lies within a gate that is the larger of a fixed distance and a multiple of the track's uncertainty, plus an altitude window.

Sticky and safe
A sensor's own track stays on its fused track while it remains within twice the gate, so tracks do not swap. Two live tracks from the same sensor are never merged.

Accuracy-weighted filtering
Position and velocity are filtered so that an accurate sensor counts for more than a coarse one; a simpler legacy filter is available as an option.

What every fused track carries

Group	Content
Identity	Stable track number (never reused during a session), callsign and classification when reported, list of contributing sensors.
Kinematics	Position, altitude, velocity, speed, heading, position uncertainty and confidence.
Rich data	Radar cross-section, Doppler, micro-Doppler image, RF emission characteristics, classification confidence, visual confirmation and other sensor properties. Each item is merged from whichever sensor reports it and expires when no longer reported.
Life cycle	A sensor's contribution ends after a set time without reports; a fused track is dropped when no contribution is left, and consoles are told.

4095
track numbers available, never reused within a session

0.1 to 10
updates per second, chosen by each console

16
consoles served at once by default

2x gate
sticky association keeps track identities stable

Illustrative diagrams, not to scale. Validated in a full simulation environment.

SENSORS, DELIVERY AND OPERATION

Built to sit between your sensors and your consoles

Sensor inputs

Standard radar track feeds
Inputs for the common surveillance-radar track and plot formats, one instance per radar, each with its own expected accuracy and source filter.

Networked short-range radar
One input represents a whole network of radar nodes; each node counts as its own contributor, so two nodes seeing one target fuse into one track.

Visual confirmation
Camera confirmation reported by any sensor is merged into the track and used by AutarchC2's Rules of Engagement.

Your own sensor
A documented plug-in template lets a sensor maker add a new input without touching the engine. Plug-ins built with different tool versions still load.

Delivery to consoles

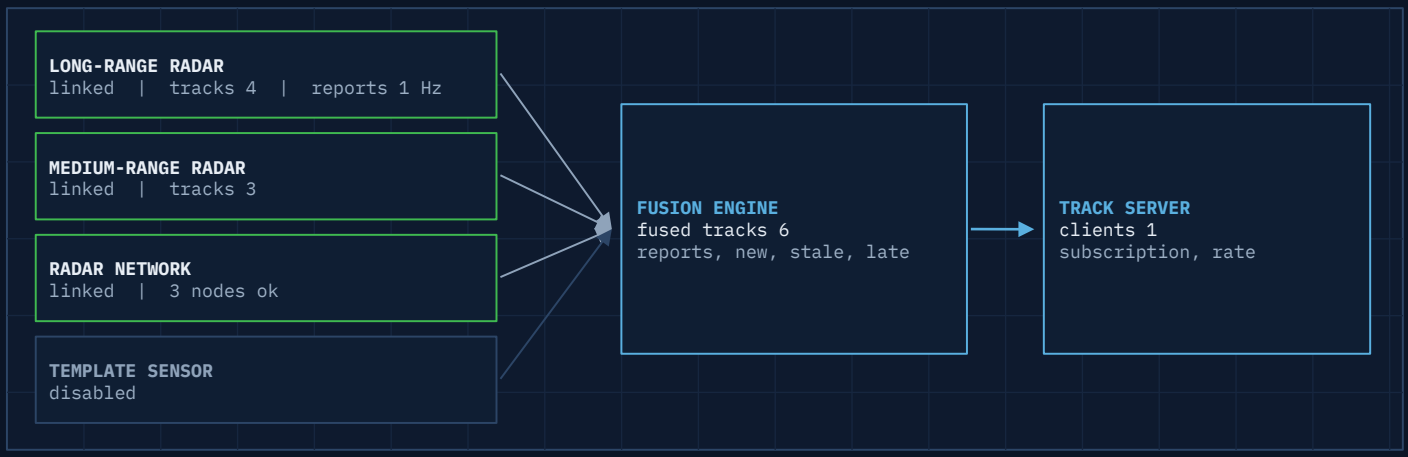
Per-console subscription
Each console chooses the track fields it needs, its update rate, whether to receive only changed tracks, and a filter by area, range, altitude or classification.

Detail on demand
Bulky data such as a micro-Doppler image is never pushed by default; a console asks for it, or subscribes to it for one selected track only.

Predictable load
Rates are bounded, slow consoles are disconnected rather than slowing others, and the internal queue is capped to keep latency predictable.

Local by default
Out of the box the picture is served to consoles on the same computer only; serving other computers is a deliberate configuration choice.

Operator view



Illustrative layout of the AutarchFusion window: every sensor block shows its type, source, uptime, tracks and reports and can be linked to or unlinked from fusion; the engine and server show live counts.

Transparent operation
Every connection, link change and error is logged, so integration problems can be traced quickly.

Live link control
An operator can take a sensor out of the fused picture and put it back without restarting anything.

Status. The sensor inputs, fusion engine and track server shown here ran together in full simulation, fed by AutarchTrackSim and consumed by AutarchC2.

FIT AND AUDIENCE

One picture from mixed sensors, ready for any console



Vendor-neutral
Mix radars and networked sensors from different suppliers in one picture, and replace one without touching the others.

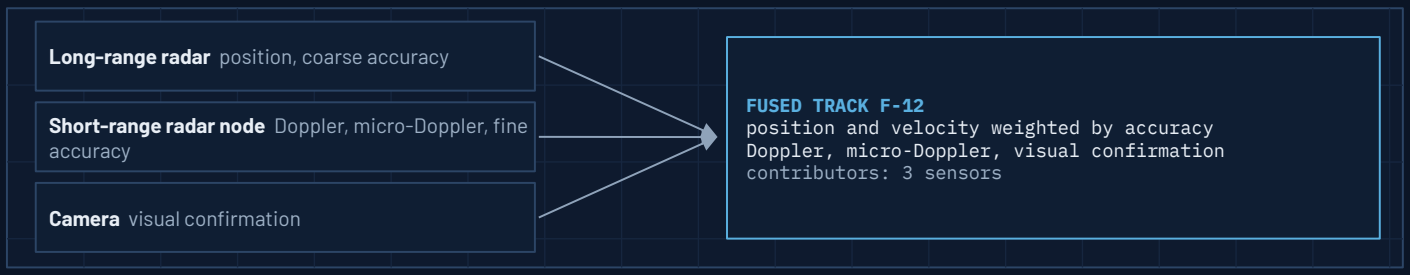
Integration without rework
A documented plug-in template on the sensor side and a simple, self-describing track subscription on the console side keep integration effort low.

A picture C2 can trust
Stable track numbers, sensor-time alignment and merged rich data give AutarchC2's Rules of Engagement the inputs they need, such as visual confirmation.

Who it is for

- Counter-UAS and air-defence system integrators
- Sensor manufacturers wanting their sensor in a fused picture
- C2 developers needing a ready track stream
- Test teams combining real and simulated sensor feeds

Example: one target, three sensors, one track



Typical workflow

1 Add sensors
Enable an input per sensor and set its expected accuracy.

2 Link to fusion
Bring each sensor into the picture and watch its counts.

3 Subscribe consoles
Each console asks for its fields, rate and area.

4 Monitor
Live counts and logs show the health of every link.

Status. Validated in a full simulation environment with AutarchTrackSim generating the radar, radar-network and camera feeds, and AutarchC2 as the subscribed console. Part of the Autarch counter-UAS suite. No fielded use is claimed.