

u-blox F9

High precision GNSS for the mass market

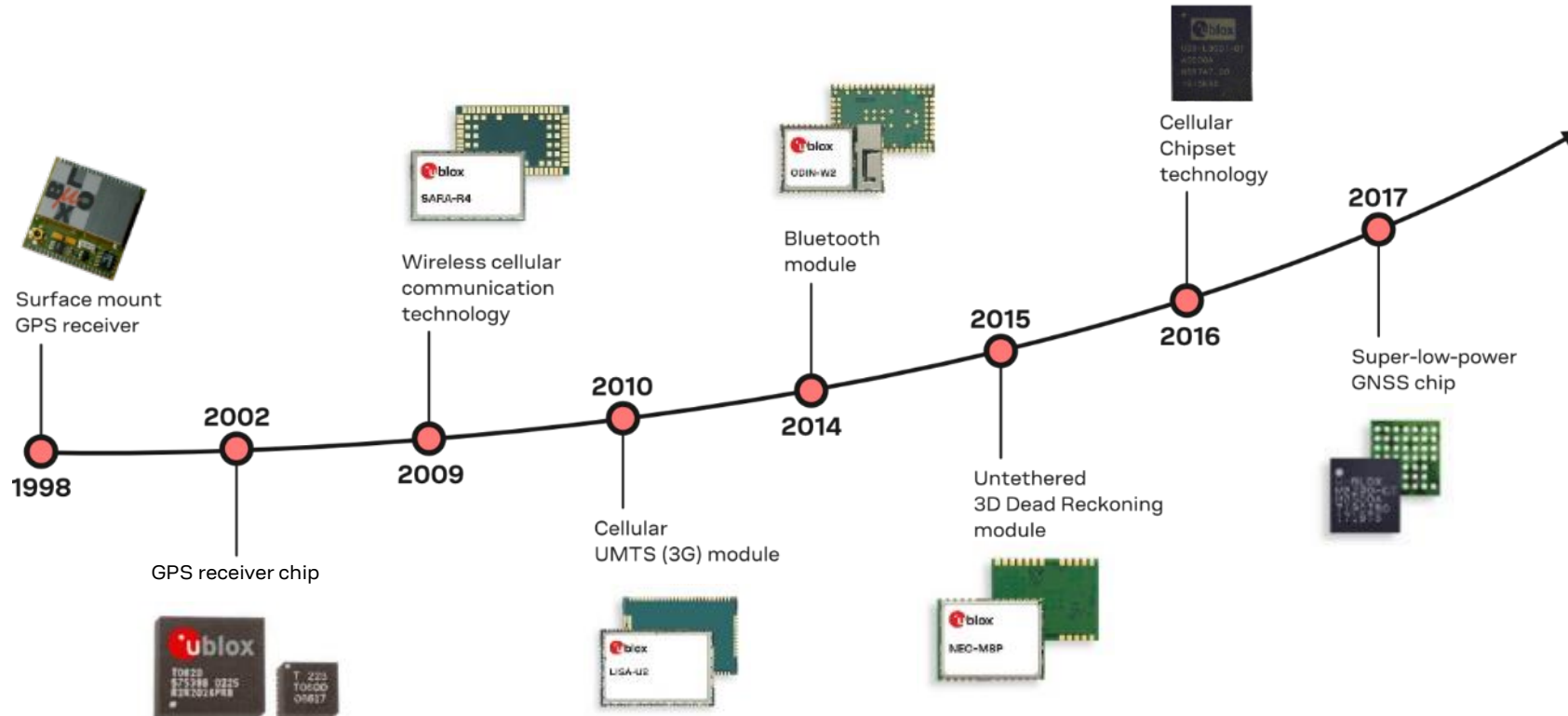


Innovation is our lifeblood

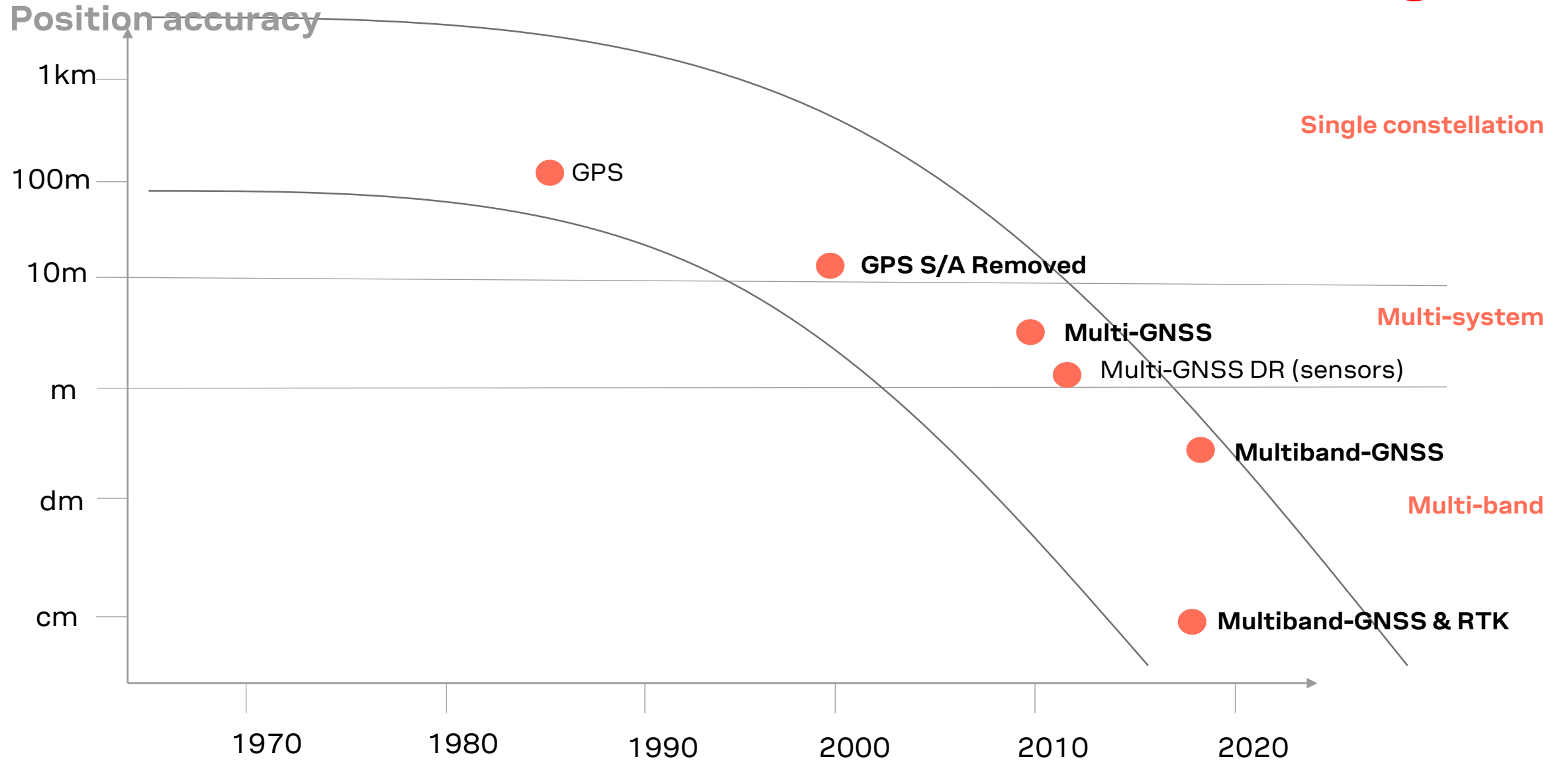
Strong innovations lead to the future



We have been first to market with many technology solutions.












GPS/GNSS evolution for Mass Market



Unique combination of technology and product offerings



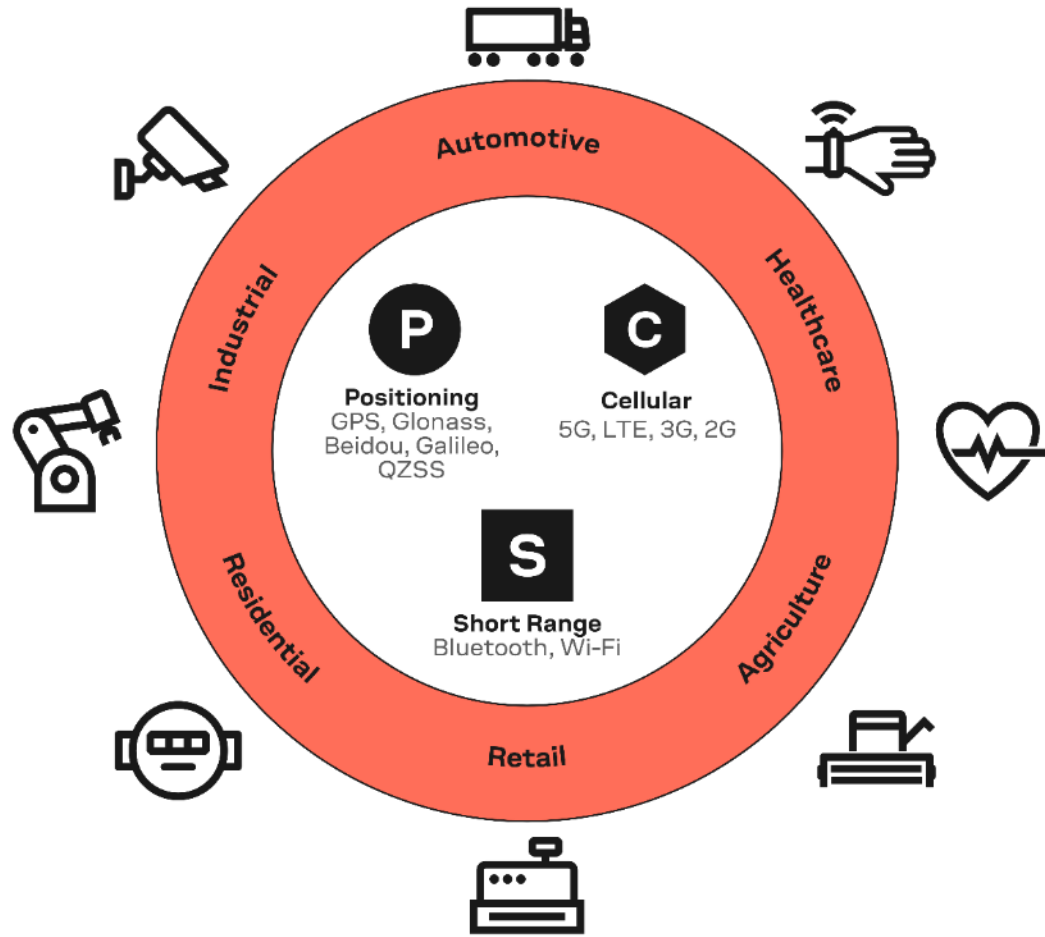
	 P Positioning	 C Cellular Communication	 S Short Range Communication
Integrated Circuits			
Modules			
Services and Solutions	CellLocate® (modem based positioning) AssistNow™ (world wide GNSS assistance service) GNSS Correction Data (for high precision)* FOTA (Firmware over the air) Lifetime Security		

The combination of our three core technologies offered in the form of chips and modules provides essential benefits to our customers.

*through Sapcorda, a Joint Venture with industry partners

Enabling the Internet of Things (IoT)

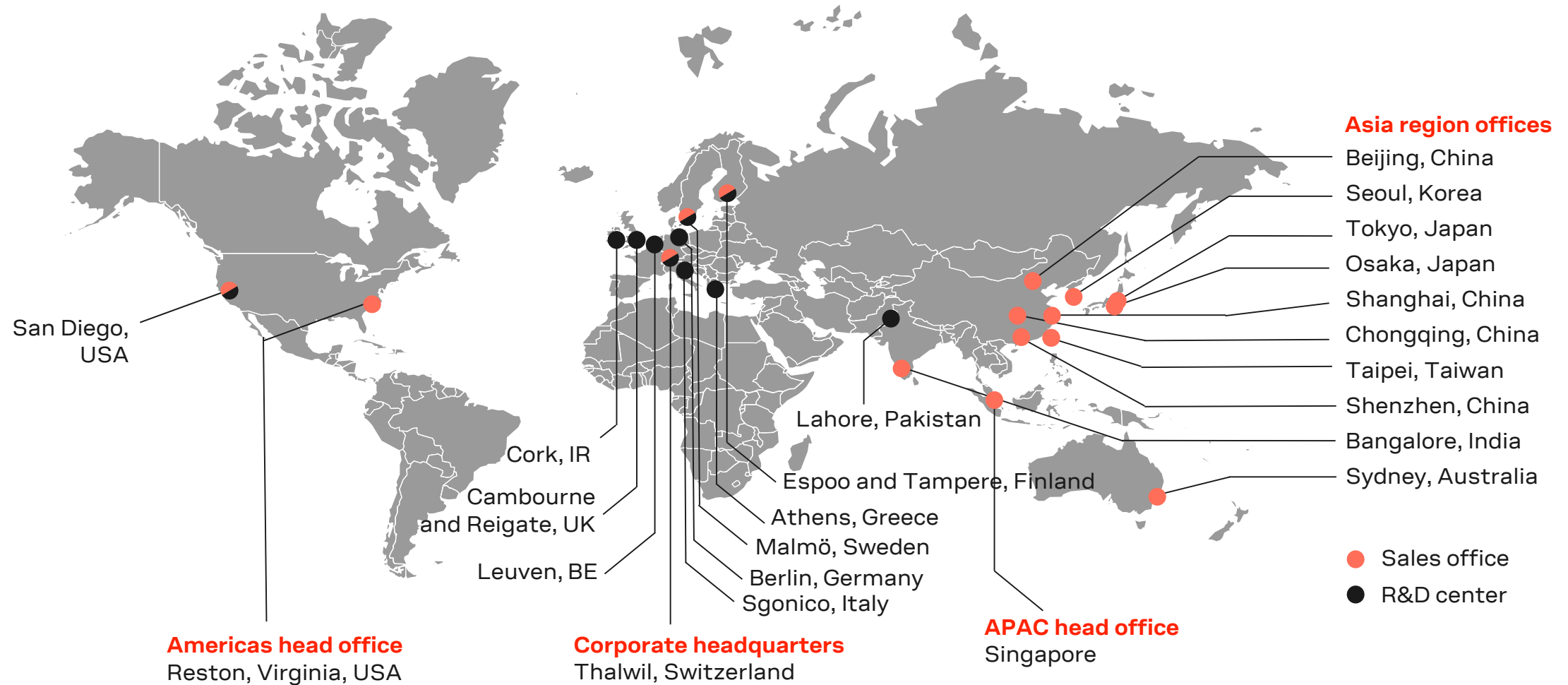
u-blox at the core



Our three technologies – Positioning, Cellular, and Short Range – transform a wide range of products and devices into the Things of the IoT.

Global presence

25 locations



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takes GNSS precision to the next level



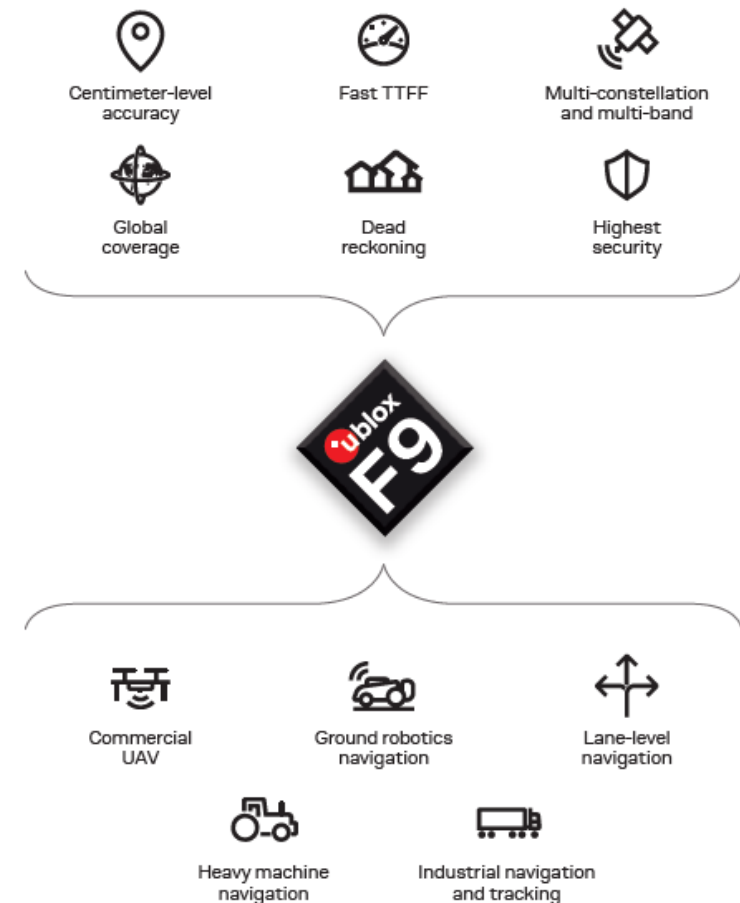
High precision is the **next frontier**

in positioning for **mass markets**,

with industrial and automotive applications

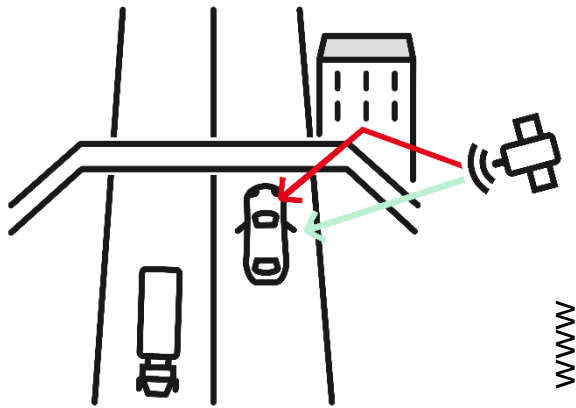
in need of a **robust** and **versatile**

high precision positioning solution

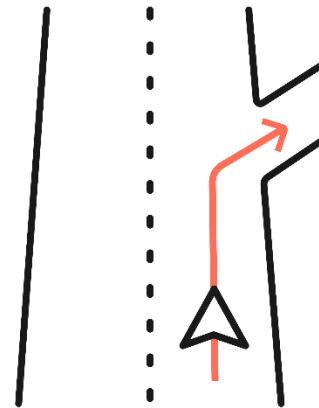


Challenges for high-accuracy GNSS

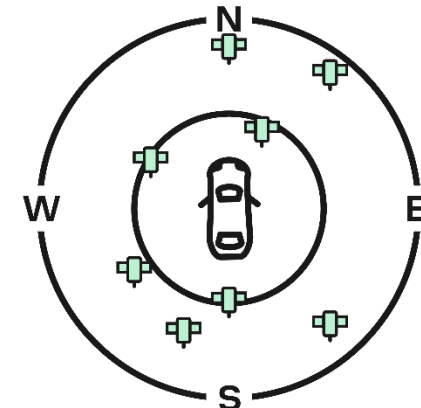
- Next generation mass market navigation applications require more automation & control
- Higher accuracy, more affordable, more versatile & globally deployable than existing solutions
- Performance of existing navigation applications in multipath & limited sky view environments



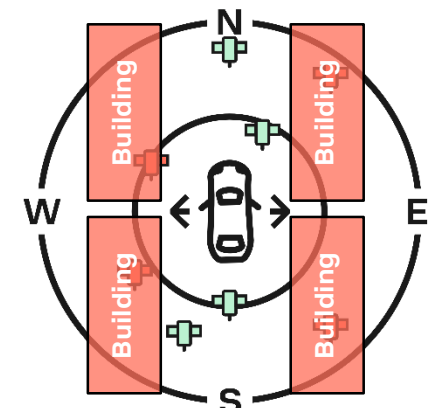
Multipath



Lane Level Navigation



Unobstructed sky view



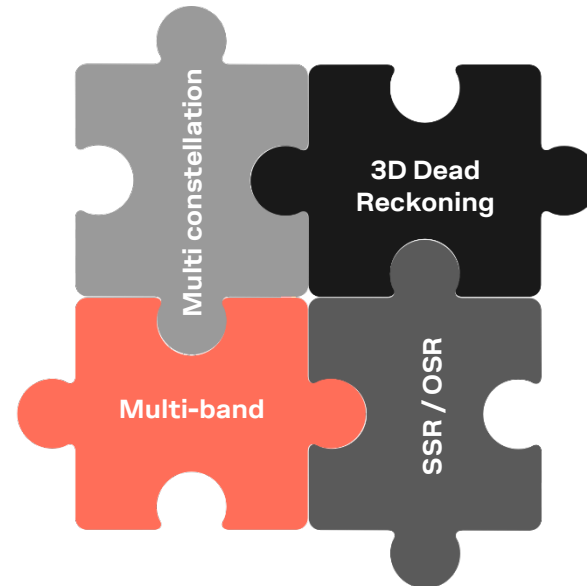
Urban sky view

Limited Sky View

u-blox F9 technology



- There is no single technology capable of providing the required position accuracy in all environments
- u-blox F9 uses a tight combination of core GNSS technologies:



- for a large number of direct line-of-sight measurements
- for fast convergence & re-convergence of high precision positions

- to smooth multipath effects, bridge obstructions
- maintain positioning in tunnels & parking garages in automotive navigation
- delivering down to centimeter-level accuracies

u-blox F9

takes GNSS precision to the next level



- Delivers accuracy down to the centimeter-level



- Paves the way for high precision navigation, augmented reality, and unmanned vehicles



- Fast time to first fix and robust performance with multi-band, multi-constellation reception



- Compatible with leading correction services for global coverage and versatility



- Dead Reckoning option for reliable performance in urban environments



- Advanced jamming and spoofing detection for highest security

Multi-band Standard Precision GNSS (SPG)

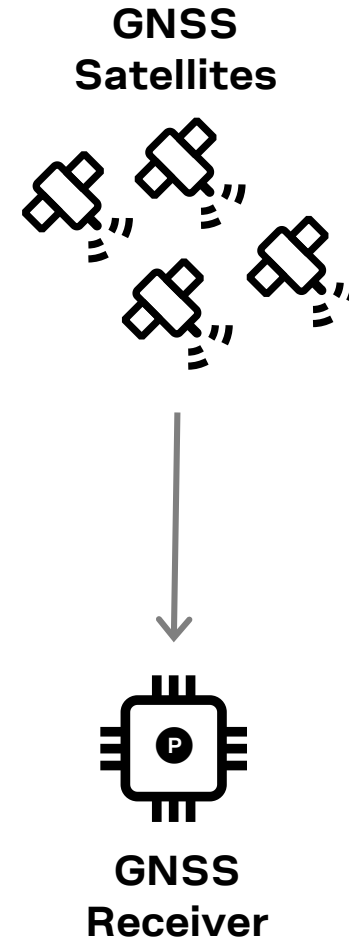
System overview



Multi-band Standard Precision GNSS system consists of:

- Multi-constellation GNSS receiver supporting multiple GNSS bands

Enables meter-level performance



High Precision GNSS (HPG)

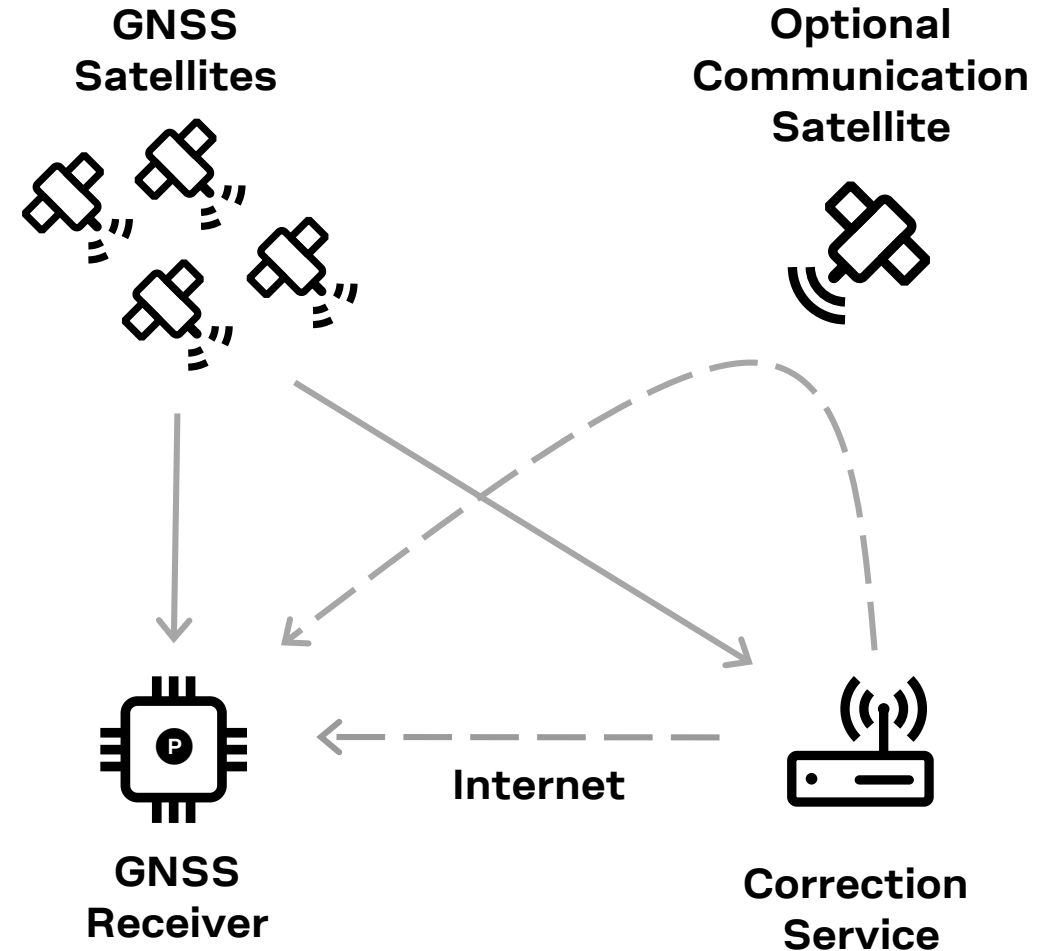
System overview



High Precision GNSS system consists of:

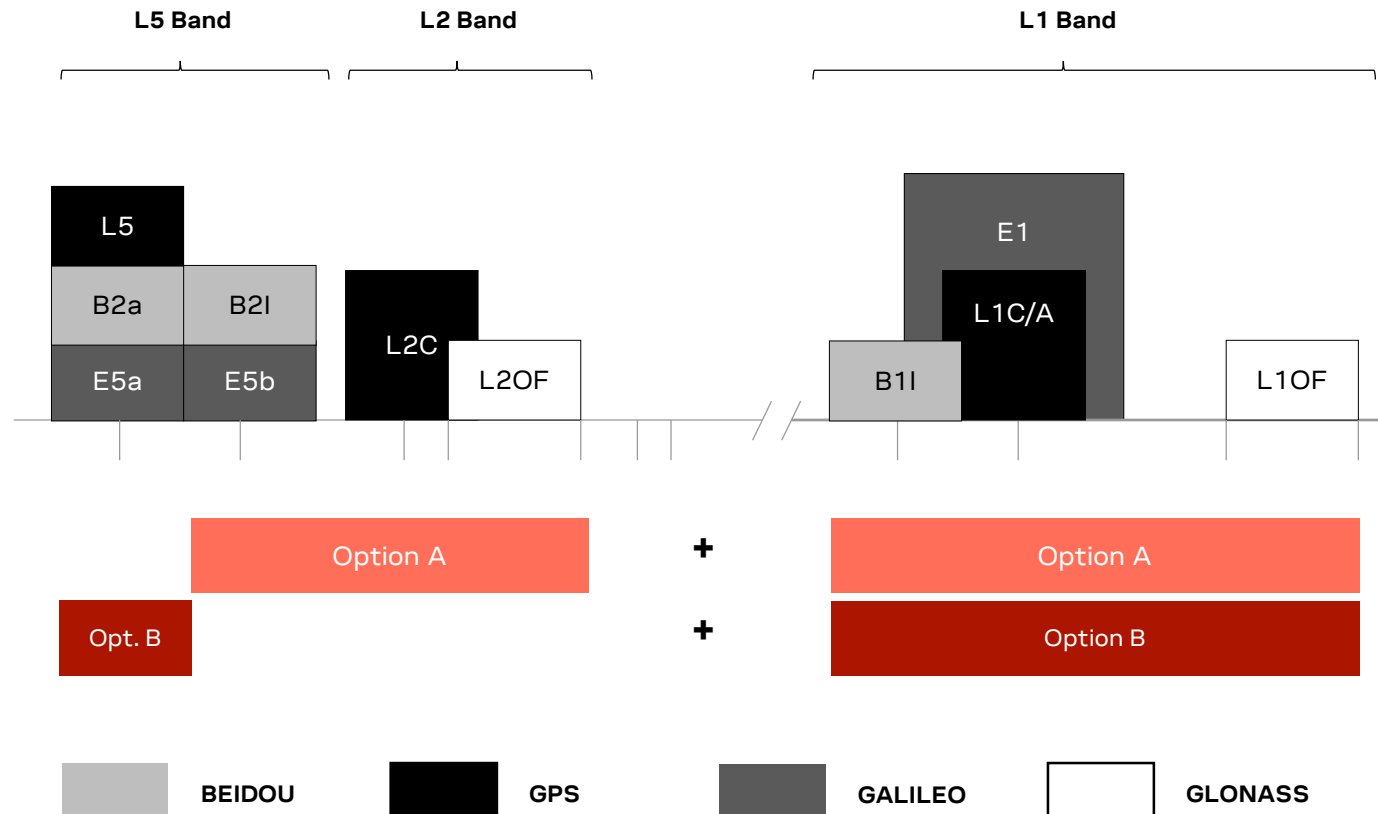
- Multi-constellation, multi-band GNSS receiver
- Integrated high precision algorithms
- GNSS correction service
- Internet connection / L-band receiver

Enables centimeter- to decimeter- level performance depending on GNSS correction service supported








GNSS Frequencies

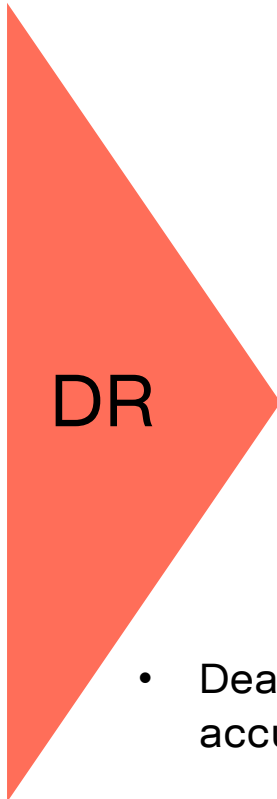
u-blox band selection



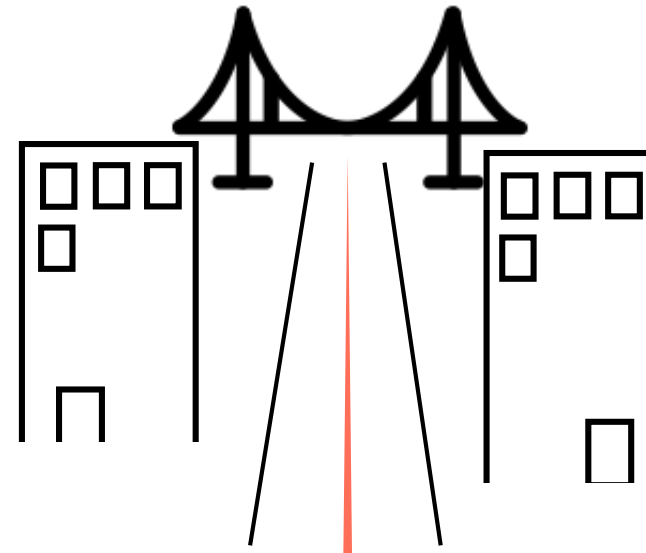
Option A enables best high precision performance & **Option B** enables best multi-band standalone performance in urban environments

Dead reckoning overcomes limitations of GNSS-only

GNSS	 gyro
	 accelerometer
	 wheel ticks
	 dynamic model
	 correction Service



Reliable Position



- Dead reckoning fuses GNSS with sensor data to calculate accurate positions even if GNSS signal is lost or degraded
- When combined with high precision GNSS centimeter to decimeter-level accuracies can be achieved, also in urban environments

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Delivers accuracy down to the centimeter-level



	u-blox F9	
	without corrections	with corrections
Type	Stand-alone GNSS	Stand-alone RTK / SSR-RTK
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS, NAVIC, SBAS	
Bands	L1 and L5	L1 and L2/L5
Corrections	SBAS, Sapcorda Basic	SBAS, SSR, RTCM 3.x
Accuracy (1-sigma)	<1.0m w/ SBAS	<1.0m w/ SBAS <0.03m (RTCM 3.x) <0.20m (SSR ^{*)})
Dead Reckoning	optional	optional
Safety features	no	no
Security features	yes	yes

^{*)} Conservative estimate. Can be <10cm with high quality SSR service

**Thank you
for your attention**