Under the patronage of **HRH Prince Khalid Al-Faisal**
Advisor to the Custodian of the Two Holy Mosques & Governor of Makkah Region

OMAINTEC FM CONFERENCE EXHIBITION 2025

المؤتمر الدولي الثاني والعشرون لإدارة الأصول والمرافق والصيانة

The 22nd International Asset, Facility & Maintenance Management Conference

Digitization - Excellence - Sustainability

How digitalization could change control systems in metro and railways systems

---

26-28 January 2025

The Ritz-Carlton Jeddah, Kingdom of Saudi Arabia

www.omaintec.com #OmaintecConf

An Intiative By

OMAINTEC
المجلس العربي لإدارة الأصول والمرافق والصيانة
Arab Asset, Facility and Maintenance Management Council

Organized by

TSG | EXICON.
The Specialist Group • شركة مجموعة المختص

DIGITALIZATION & INNOVATION IN THE RAILWAYS & METRO CONTROL SYSTEMS

How digitalization could change control systems in metro and railways systems

WHO AM I?

لنتحدث عن التنقل
Reden wir über mobilität
Parlons de mobilité
Parliamo di mobilità
Let’s talk about mobility
让我们来谈谈移动性

Simone Bernasconi

Chief Risk and Certification Officer / CEO Advisor at Manta Aircraft
Head of Advanced Transportation Programs at SUPSI
Founder of Avalle, Editor of Mobilities, Host and creator of meets

My areas of expertise/teaching

Advanced Air Mobility	Safety, Risk & Crisis Management
Future Mobility	Strategy & Business Development
Public Transportation	Innovation & Creativity
Aviation & Airports	Maintenance & Engineering
Transportation, SCM	Certification
High-Tech Industries	Operations
Emerging Technologies	Events, Conferences & Marketing

WHO AM I?

لنتحدث عن التنقل
Reden wir über mobilität
Parlons de mobilité
Parliamo di mobilità
Let’s talk about mobility
让我们来谈谈移动性

Simone Bernasconi

Chief Risk and Certification Officer / CEO Advisor at Manta Aircraft
Head of Advanced Transportation Programs at SUPSI
Founder of Avalle, Editor of Mobilities, Host and creator of meets

With nearly 30 years of experience in various technical, project/program management and executive positions in the aviation and mobility sectors, I have consistently demonstrated my role as a responsible leader by consistently achieving goals in complex and harsh environments. I am an innovator, storyteller, creative engineer, mentor and strategist. I have been on the move around the world for decades and have now settled in Uster (Switzerland) since 2018. I am a father of one daughter and happily married.

My professional life is deeply rooted in my values. I firmly believe that simplicity is the key to success, that innovation goes beyond technology, and that respect is the cornerstone of lasting relationships. I am also certain that mobility is the lifeblood of business, cultural exchange, sustainable development, social inclusion and much more...

ABOUT THE WORKSHOP

- Mobile phone switch to silent, please.
  (You can leave the room if there is an urgent matter.)
- Do not talk when others are speaking.
- Interactive workshop! Your active participation is required.

PART 1: I present, you learn and question.

- My contribution to your knowledge.

PART 2: You work, I help.

- Your active work to create a concept.

PART 3: You present, we applaud.

- Your storytelling time. Share with the audience.

OBJECTIVES

- Understand the basics behind TCS
- Understand control system of other industries (Aviation, automotive).
- Develop a new/future concept for the Train Control System of the next generations.


AVALLE
MEETS
Davide Campari Lounge
August 14, 2025, 18:14
Co-sponsor
DARA CAPITAL
WEALTH AND INVESTMENT MANAGEMENT
In cooperation with
Locarno
Film Festival

WORKSHOP AGENDA

- Welcome and Introduction (5 min.)
- Key Insights (5 min.)
- Emerging Technology Cards (5 min.)
- Basic Principles of Control Systems (5 min.)
- Lessons from other industries, e.g. aviation, mobility (5 min.)
- Future Trends (5 min.)
- Working Groups (20 min.)
- Group Presentations (5 min. per Group)
- Closing and Takeaways (5 min.)

IS TRANSPORTATION / MOBILITY IMPORTANT?

هل النقل/التنقل مهمان؟

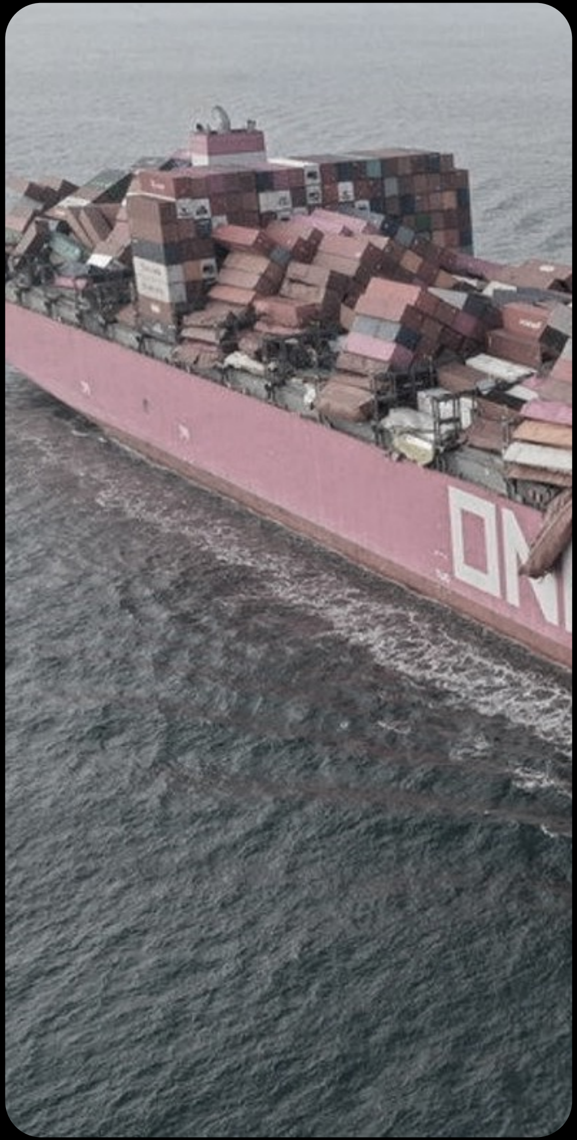
HOW IMPORTANT?

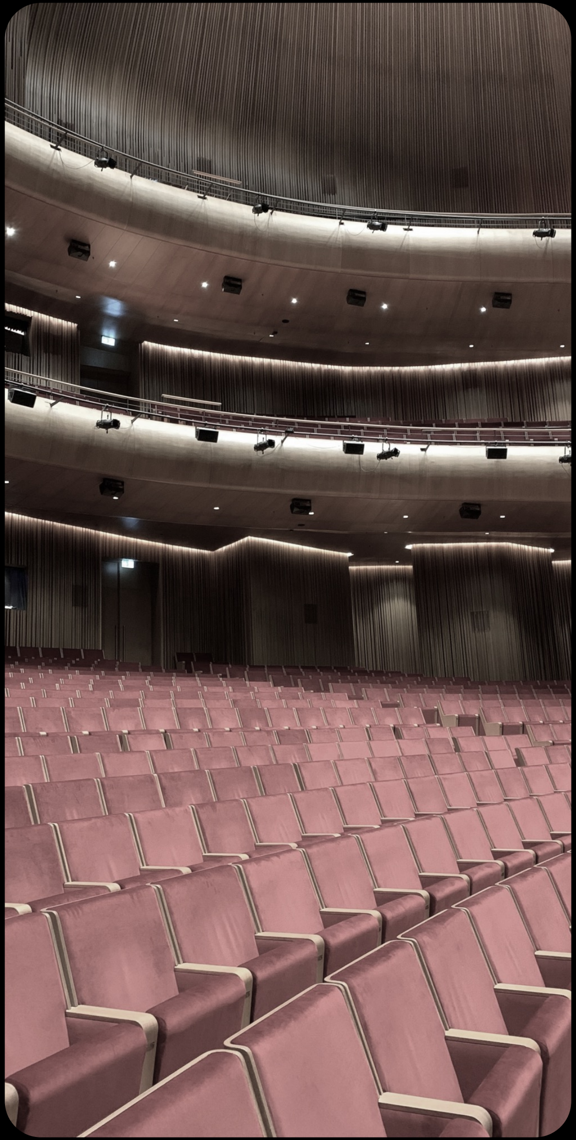
هل النقل/التنقل مهمان؟

WHAT HAPPENS IF THE TRANSPORTATION SYSTEM STOPS?

ماذا يحدث إذا توقف نظام النقل؟

SUPPLIES, ECONOMY, CULTURE, “LIFE” STOPS!





PERCEPTIONS

IN EVERY SITUATION, HOW YOU PROCESS THE INFORMATION IS IMPORTANT!

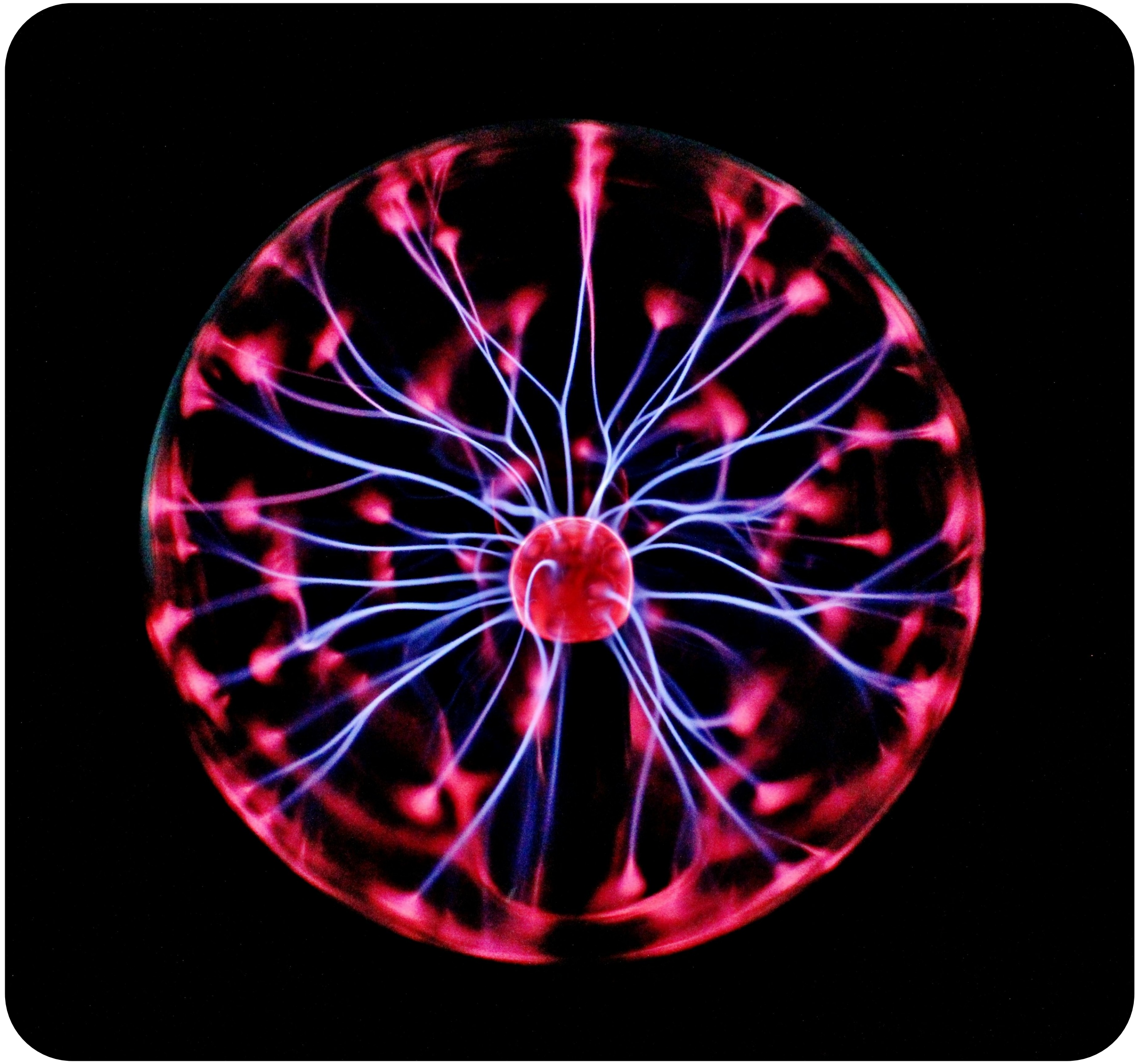
EMERGING TECHNOLOGY CARDS

You will have several information at your fingertips.

All Tech Cards are at the end of this presentation and should be printed in 3 copies for the group work.

In these cards you find, different sources (4) for emerging technologies.

You may uses this information to create your control system.



STATUS QUO?

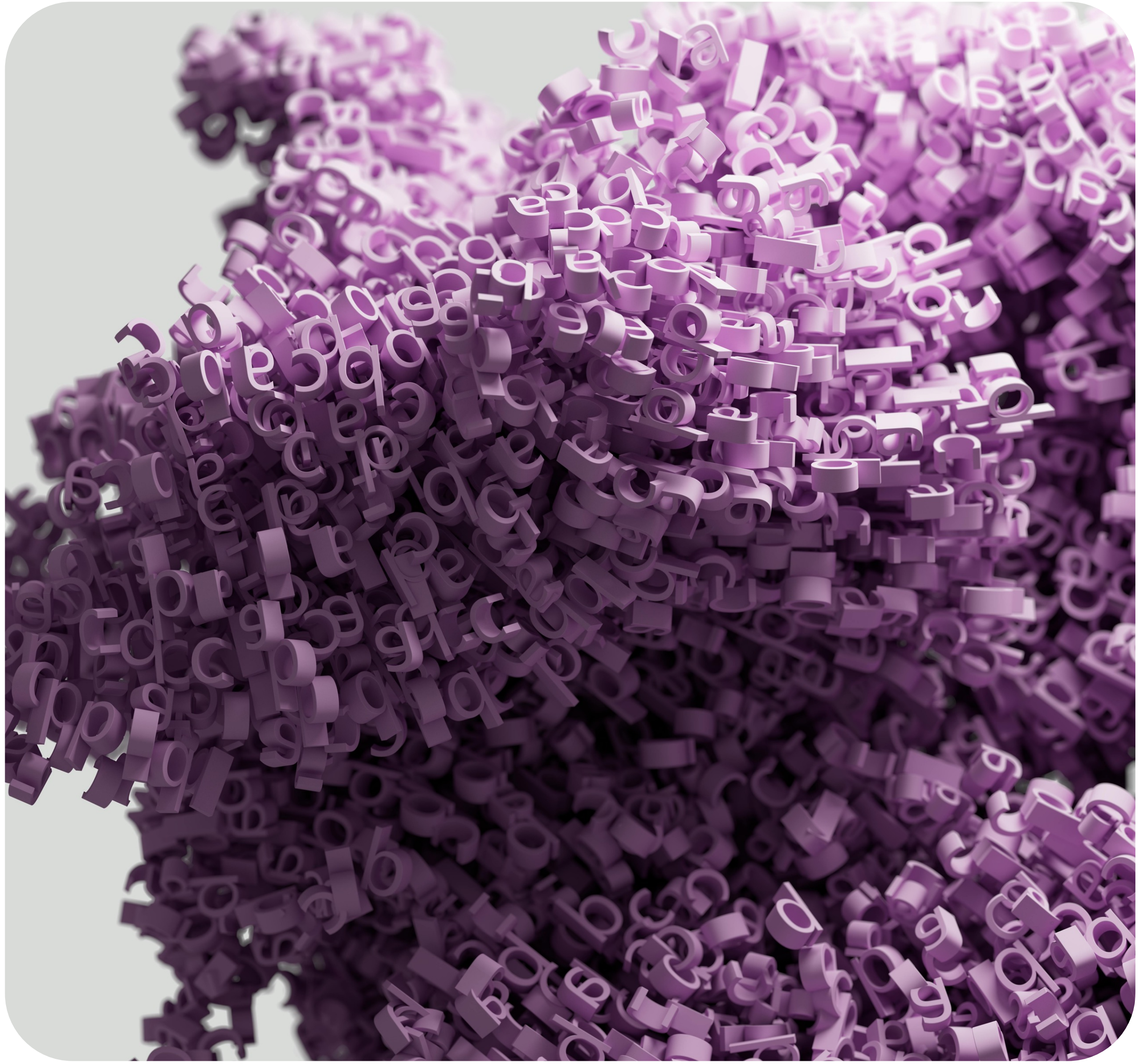
Technolgies / Science

vs.

Human being

vs.

Regulators / Government



DIGITAL PERISCOPE 2018

Digital Periscope 2018

Artificial Intelligence #AI /Machine Learning / Deep Learning
Internet of Things #IOT / #IIOT & Sensors & Wearables
Mobile & Social Internet — Advancements, Social Networks/Media, Search, Messenging and Livestreams
Blockchain — Cryptocurrencies, Distributed Ledger Systems, DAOs, DApps
Big Data — Apps, Infrastructure & Predictive Analytics
Automation — Information, Task, Process, Machine, Decision & Action
Robots incl. Drones & Autonomous Vehicles — Consumer/Commercial/Industrial Robots and Robotics
Immersive Media — #VR/ #AR/ #MR/ 360°
Mobile Technologies & Advancements — infrastructure, networks, standards, services & devices
Cloud Computing — Software-as-Service (SaaS), Infrastructure-as-a-Servcie (IaaS), Platform-as-a-Service (PaaS) & MESH Apps
3D Printing — Additive Manufacturing and Rapid Prototyping
CX — Customer Journey, Experience, Personalization & Commerce Tools
EnergyTech — Efficiency, Storage & Decentralized Grid
Cybersecurity incl. Adaptive Security — Security, Intelligence Detection, Remediation & Adaptation
Voice Assistants -Interfaces, Chatbots & Natural Language Processing
Nanotechnology - Computing, Medicine, Machines + Smart Dust
CollaborativeTech — Crowd, Sharing, Workplace & Open Source Platforms & Tools
Health Tech — Advanced Genomics, Bionics & Health Care Tech.
Human-Computer Interaction — Facial/Gesture Recognition, Biometrics, Gaze Tracking
Geo-spatial Tech — GIS, GPS, Mapping & Remote Sensing, Scanning, Navigation
Advanced Materials — Composites, Alloys, Polymers, Biomimicry, Nanomanufacturing
New Touch Interfaces — Touch Screens, Haptics, 3D Touch, Paper, Feedback & Exoskeletons
Wireless Power
Clean Tech. — Bio-/Enviro-Materials + Solutions, Sustainability, Treatment & Efficiency
Quantum Computing — + Exascale Computing
Smart Cities — Infrastructure & Transport
Edge/Fog Computing
Faster, Better Internet — Broadband incl. Fiber, 5G, Li-Fi , LPN and LoRa
Proximity Tech. — Beacons, .RFID, Wi-Fi, Near-Field Communications & Geofencing
New Screens — next evolution TVs, Digital Signage, OOH, MicroLEDS & Projections

SSBM GENEVA, FYND AC. 2024

SSBM Geneva 2024
Generative AI
Quantum Computing
5G Expansion
Virtual Reality (VR) 2.0
Augmented Reality (AR)
Internet of Things (IoT) in Smart Cities
Biotechnology in Agriculture
Autonomous Vehicles
Blockchain Beyond Cryptocurrency
Edge Computing
Personalized Medicine
Neuromorphic Computing
Green Energy Technologies
Wearable Health Monitors
Extended Reality (XR) for Training
Voice-Activated Technology
Space Tourism
Synthetic Media
Advanced Robotics
AI in Cybersecurity
Digital Twins
Sustainable Technology
Telemedicine
Nanotechnology
Hybrid Work Technologies

Fynd Academy 2024
Artificial Intelligence (AI)
Machine Learning (ML)
Quantum Computing
5G Networks
Blockchain
Internet of Things (IoT)
Augmented Reality (AR)
Virtual Reality (VR)
Edge Computing
Autonomous Vehicles
Robotics
Biotechnology
Genetic Engineering
Cloud Computing
Nanotechnology
Drones
Digital Twins
Smart Cities

Fynd Academy 2024
Cybersecurity Advancements
Wearable Technology
Predictive Analytics
Natural Language Processing (NLP)
Cryptocurrency
Renewable Energy Tech
Voice Assistants
Smart Manufacturing
3D Printing
Smart Healthcare Solutions
Chatbots
AI-powered Cyber Defense Systems

TECHVISION 50 – 2024

TECHVISION 50 – 2024 (1/2)

AI, Digital and Computing Technologies	-
AI, Digital and Computing Technologies	AI emotion and expression recognition
AI, Digital and Computing Technologies	Artificial general intelligence (AGI)
AI, Digital and Computing Technologies	Biologically inspired AI
AI, Digital and Computing Technologies	Brain machine interface (BMI) technologies
AI, Digital and Computing Technologies	Quantum algorithms
AI, Digital and Computing Technologies	DNA data storage
AI, Digital and Computing Technologies	New computing models
AI, Digital and Computing Technologies	Novel immersive interfaces
Advanced Materials and Manufacturing	-
Advanced Materials and Manufacturing	4D printing
Advanced Materials and Manufacturing	Biomimetic materials
Advanced Materials and Manufacturing	Nanoparticle manufacturing
Advanced Materials and Manufacturing	Metamaterials
Electronics, Photonics and Quantum Technologies	-
Electronics, Photonics and Quantum Technologies	Alternative and novel semiconductor systems
Electronics, Photonics and Quantum Technologies	Emerging microscopy techniques
Electronics, Photonics and Quantum Technologies	Hyperspectral imaging
Electronics, Photonics and Quantum Technologies	Millimetre wave and terahertz technologies
Electronics, Photonics and Quantum Technologies	Photon generators
Electronics, Photonics and Quantum Technologies	Plasmonics
Electronics, Photonics and Quantum Technologies	Post-quantum cryptography
Electronics, Photonics and Quantum Technologies	Room temperature superconductors
Energy and Environmental Technologies	-
Energy and Environmental Technologies	Cross-linked polymer recycling
Energy and Environmental Technologies	Gridscale wireless energy transmission and charging
Energy and Environmental Technologies	Hypersonics

TECHVISION 50 – 2024

TECHVISION 50 – 2024 (2/2)

Energy and Environmental Technologies	Novel propulsion or ion based propulsion
Energy and Environmental Technologies	Novel hydrogen production and storage technologies
Energy and Environmental Technologies	Nuclear fusion
Energy and Environmental Technologies	Space-based solar power
Biotechnology	-
Biotechnology	Artificial cells and artificial life
Biotechnology	Bacteria and microbe manufacturing
Biotechnology	Biocatalytic membranes
Biotechnology	Bioelectronics and electroceuticals
Biotechnology	Hybrid microbe biotechnology
Biotechnology	Programmable cells
Biotechnology	Biofabrication in tissue engineering
Health and Medical Technology	-
Health and Medical Technology	Adult stem cell generation
Health and Medical Technology	Fluxomics
Health and Medical Technology	Anti-ageing drugs
Health and Medical Technology	Antibiotic replacements
Health and Medical Technology	Microbiome therapeutics
Health and Medical Technology	Personalised RNA therapeutics
Health and Medical Technology	Phased genome assembly tools
Health and Medical Technology	Sensation detection implants
Health and Medical Technology	Whole body-on-a-chip device
Robotics and Space Technologies	-
Robotics and Space Technologies	Fully autonomous vehicles
Robotics and Space Technologies	Nanoscale robotics
Robotics and Space Technologies	Robotic off-world manufacture
Robotics and Space Technologies	Soft robotics
Robotics and Space Technologies	Space nuclear power and novel space propulsion systems
Robotics and Space Technologies	Very low earth orbit (VLEO) satellites

WEF STRATEGIC INTELLIGENCE

WEF – Strategic Intelligence
TOP 10 Emerging Tech (2025)
AI for Scientific Discovery
Alternative Livestock Feeds
Carbon Capturing Microbes
Elastocalorics
Genomics for Transplant
High Altitude Platforms
Immersive Technology for the Build World
Integrated Sensing and Communication
Privacy Enhancing Technologies
Reconfigurable Intelligent Surfaces

Topics of strategic importance (2025)
Advanced Energy Solutions
Aerospace and Aviation
Advanced Materials
Artificial Intelligence
Automotive and New Mobility
Batteries
Behavioural Sciences
Blockchain
Clean Power for Industry
CO2 Capture, Utilization and Storage
Cybersecurity
Data Science
Digital Communication
Digital Identity
Disinformation

Topics of strategic importance (2025)
Drones
Electricity
Energy Transition
Flexible Batteries
Flexible Neural Electronics
Geopolitics
Global Governance
Global New Mobility Coalition
Global Risks
GovTec
Heavy Industry
Hydrogen
Mobility
Net Zero Carbon Cities
Nuclear Security
Oil and Gas
Renewable Energy
(SDGs)
Semiconductors
Space
Superconductivity
Supply Chain and Transport
Sustainable Development
Transport
Travel and Tourism
Wearables

MATURE / NEW / EMERGING TECHNOLOGY TITLE

What is it?
A Brief description of the technology identified in your quick search.

Why is it important?
Your opinion of why this technology is important and some examples of applications for the transportation and mobility sector.

What is it?

Why is it important?

WHY WE NEED A TRAIN CONTROL SYSTEM?

Do we really need a control system?

WHY WE NEED A TRAIN CONTROL SYSTEM?

Safety
Efficiency & OPS
Sustainability

Complex operations
Infrastructure limits
Legacy technologies

HIGH LEVEL TRAIN CONTROL SYSTEM

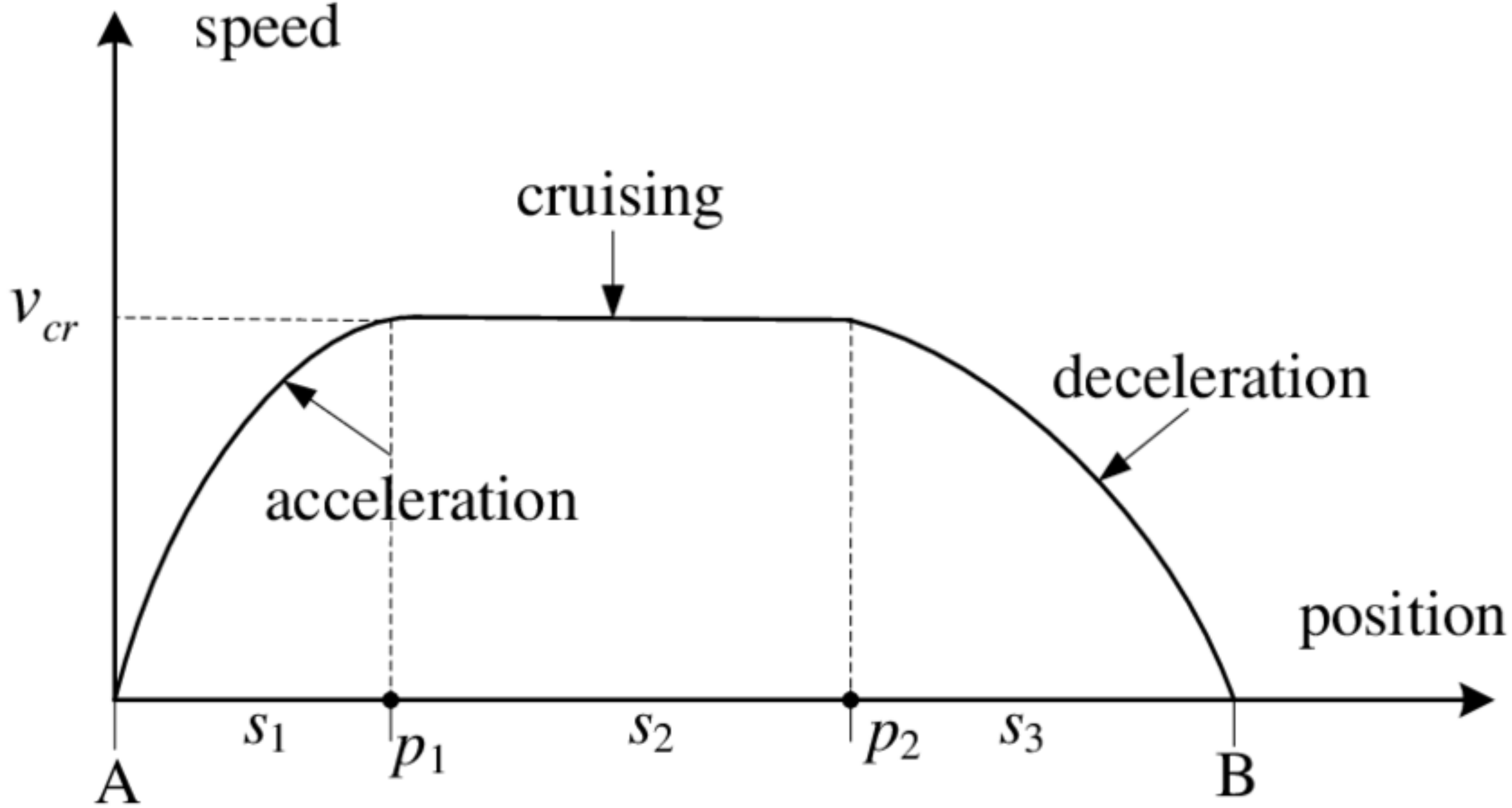
Track Blocks

Speed Curves

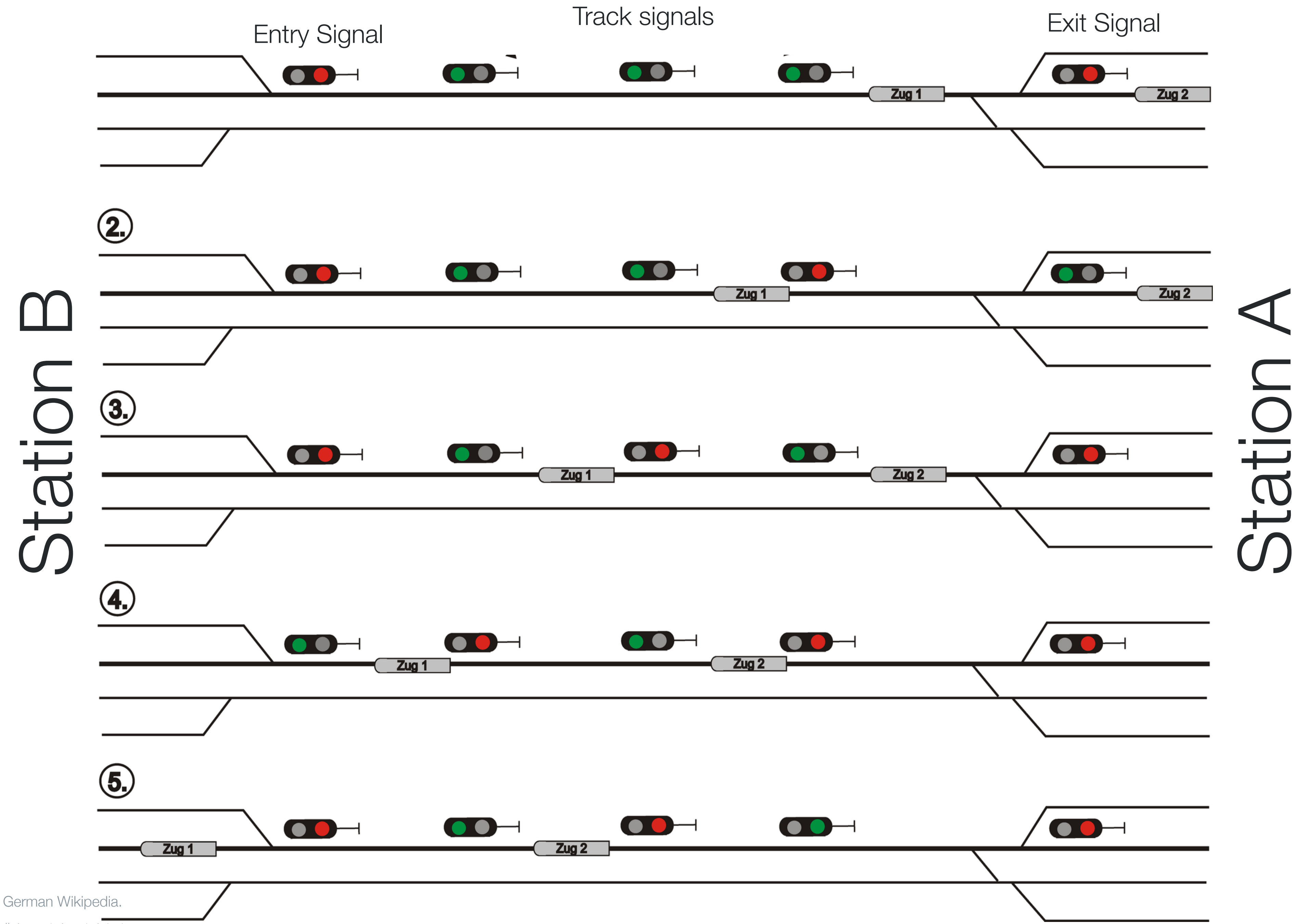
Interlocking

Control Centers

SPEED CURVE


speed
cruising
v_{cr}
deceleration
acceleration
position
s_1
p_1
s_2
p_2
s_3
A
B

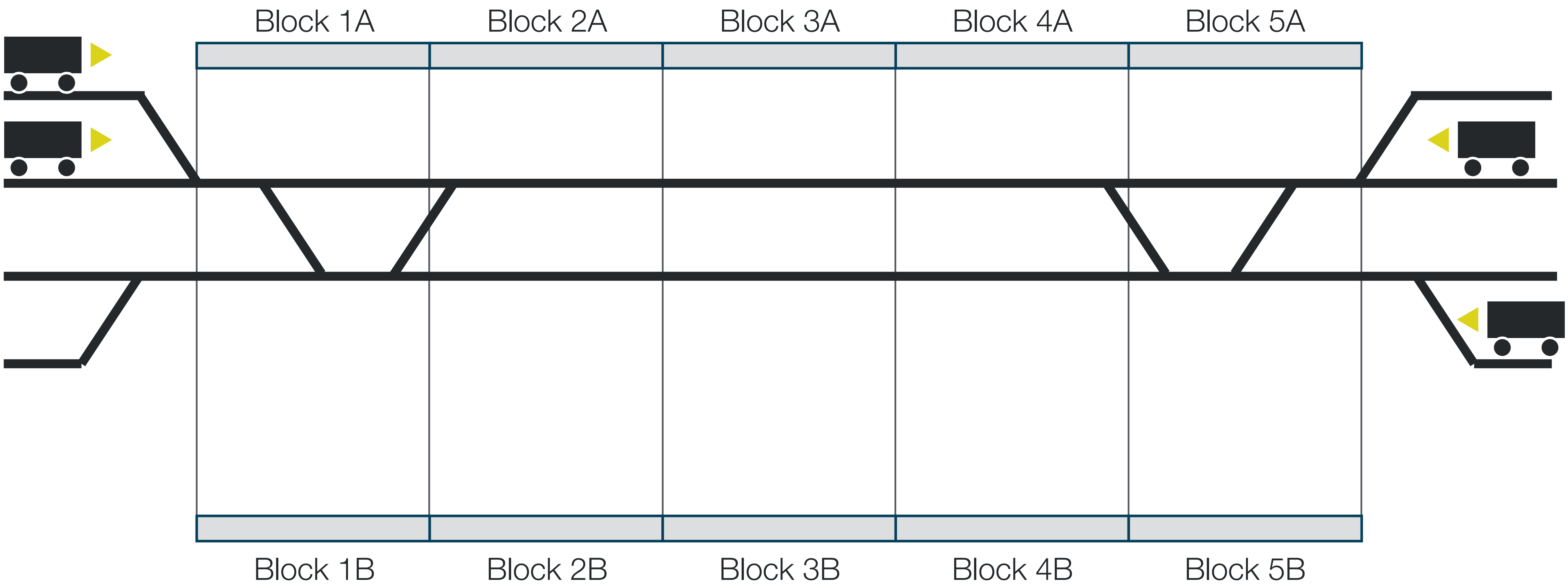
TRACKS EXAMPLES



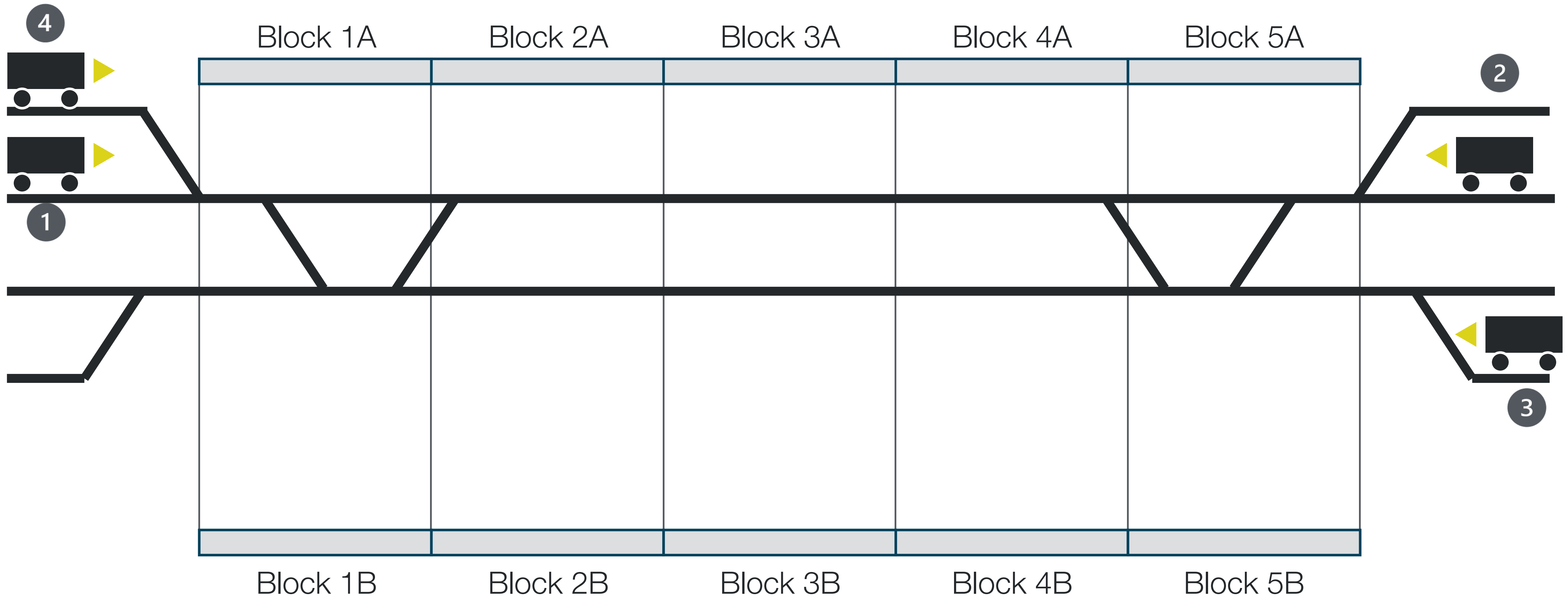
By The original uploader, GFHein1113 at German Wikipedia.

TRACK BLOCKS - INTERLOCK

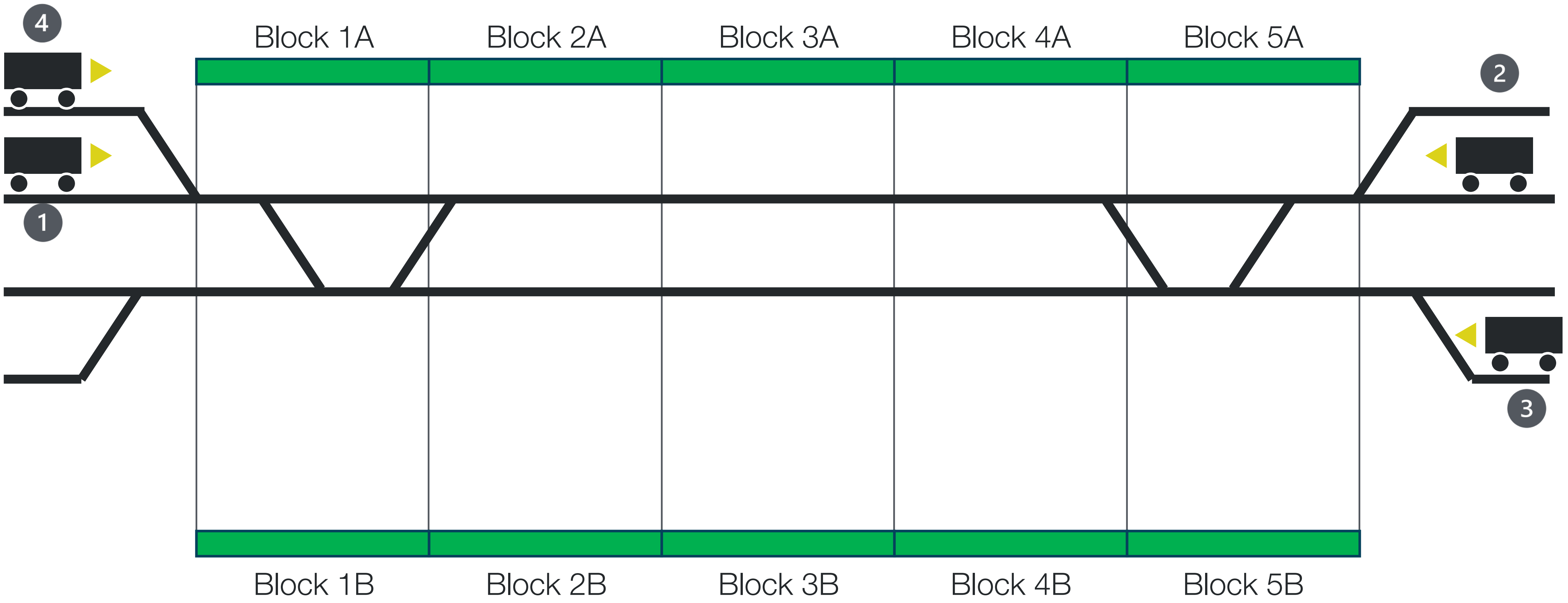
TRACK BLOCKS - INTERLOCK



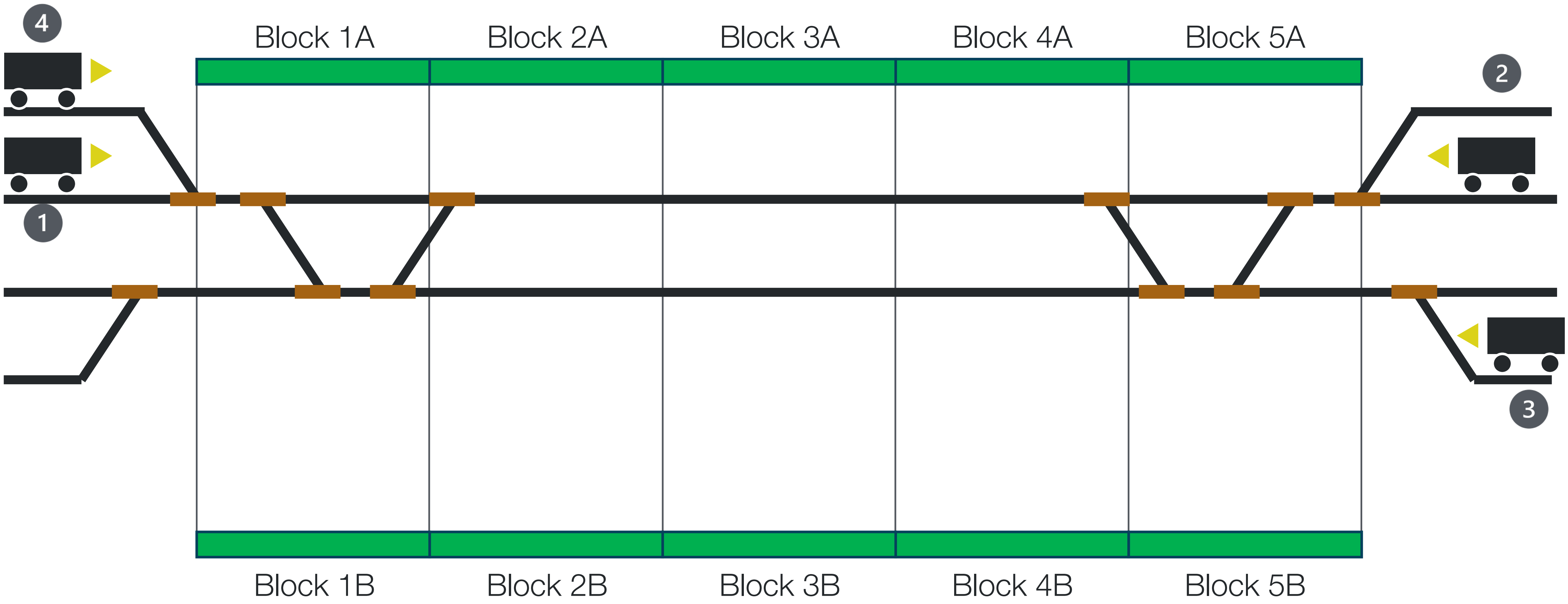
TRACK BLOCKS - INTERLOCK



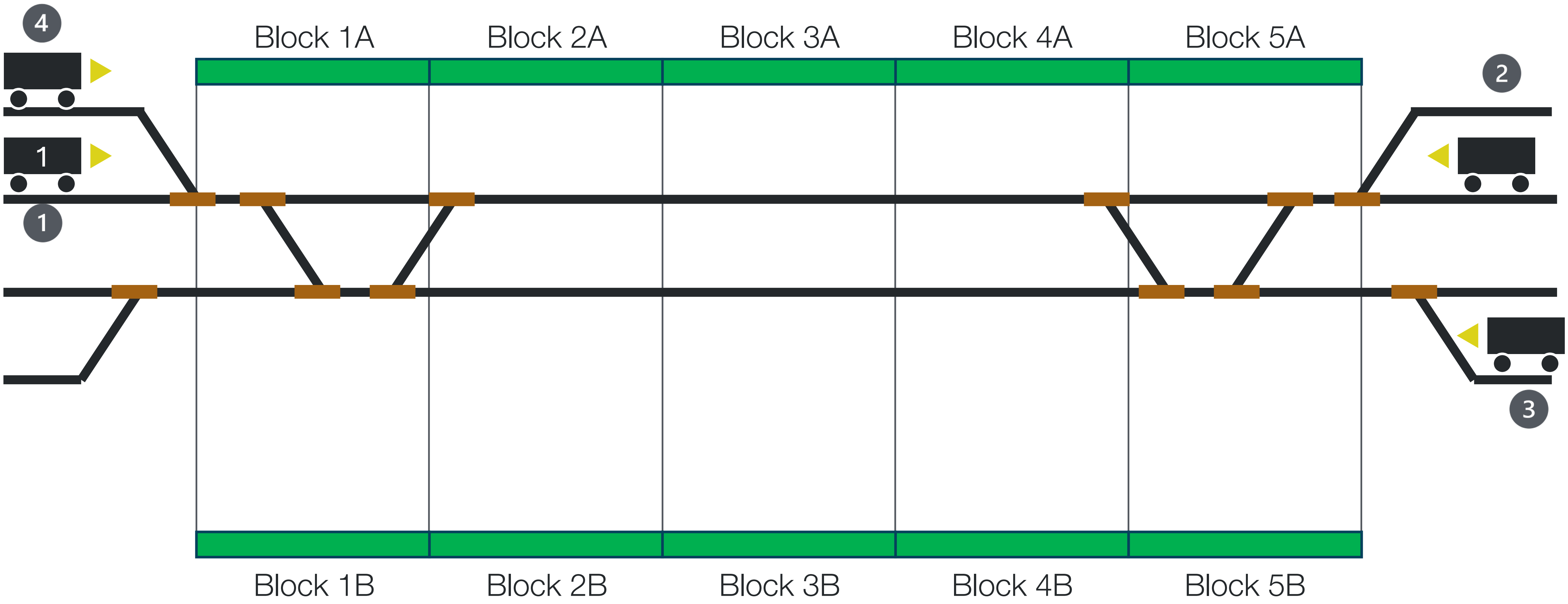
TRACK BLOCKS - INTERLOCK



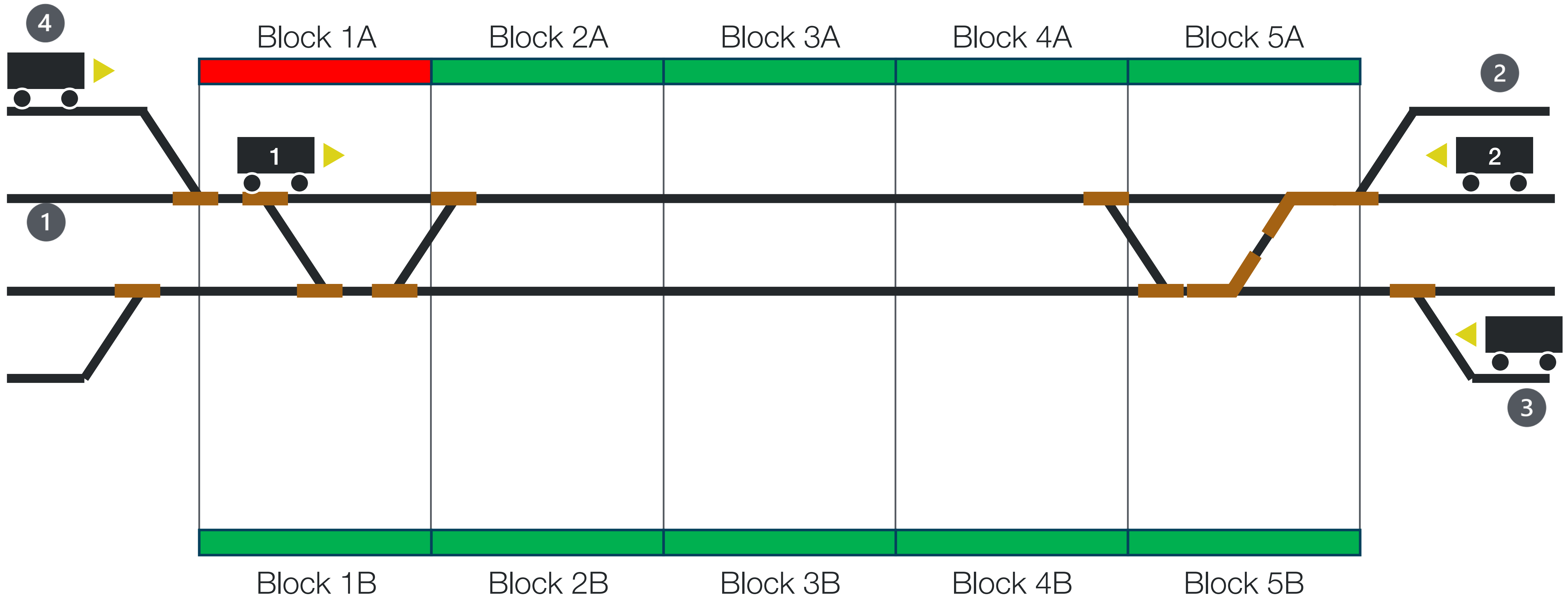
TRACK BLOCKS - INTERLOCK



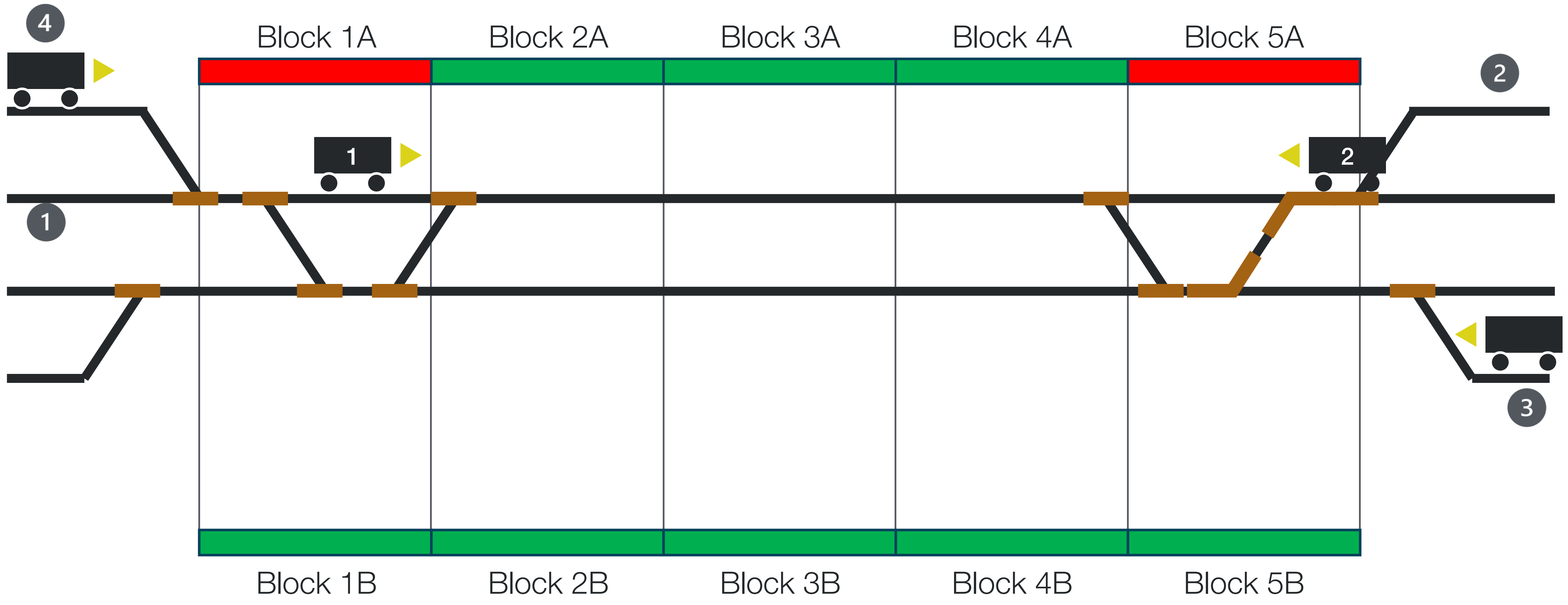
TRACK BLOCKS - INTERLOCK



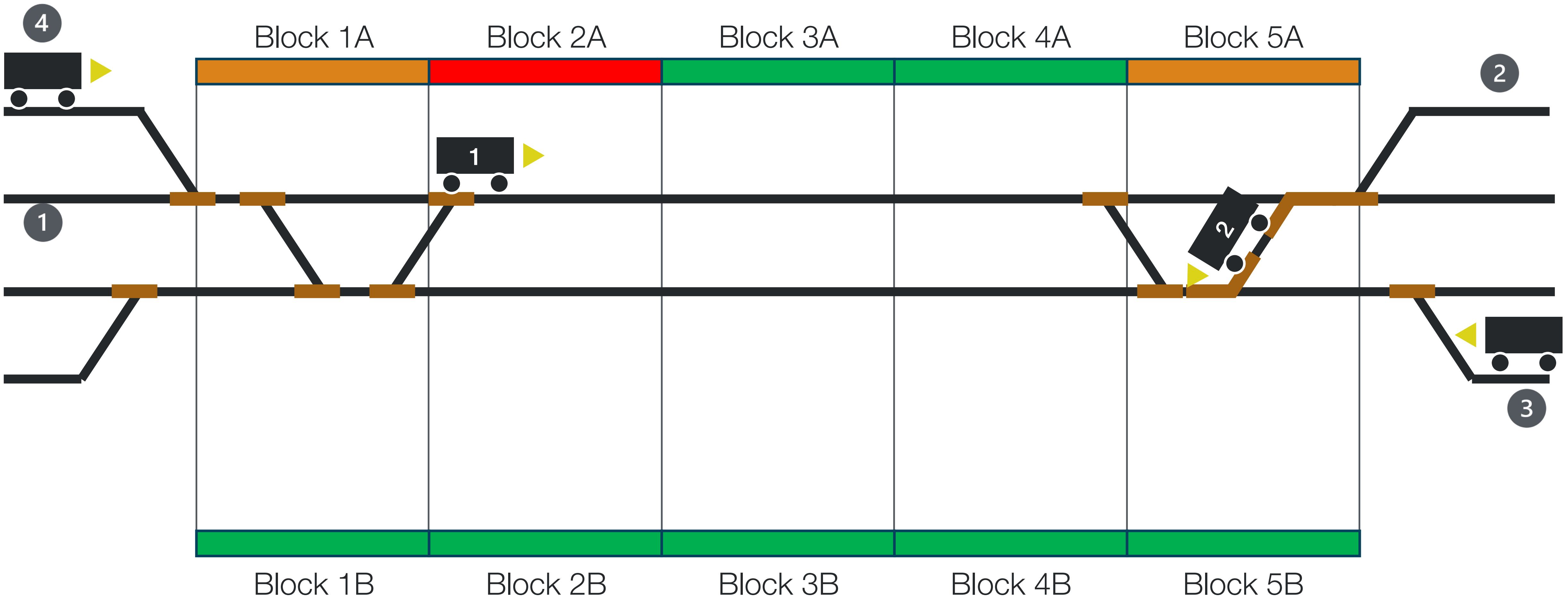
TRACK BLOCKS - INTERLOCK



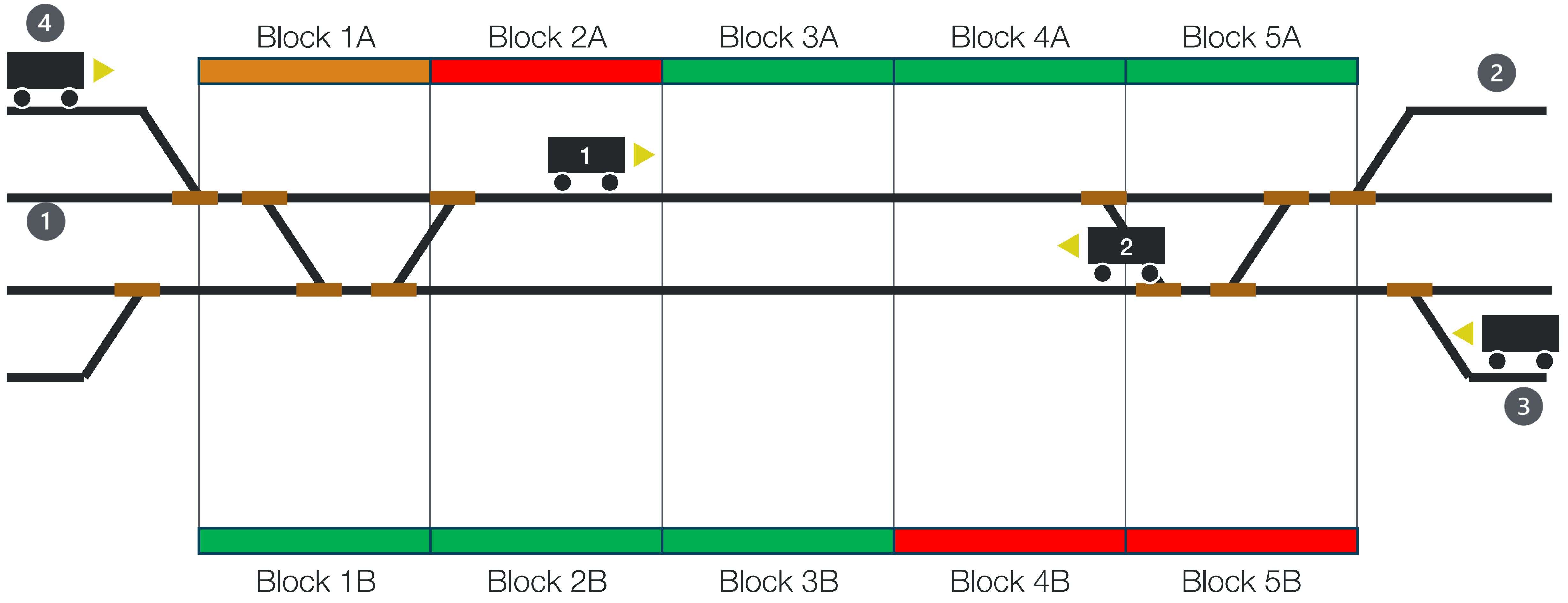
TRACK BLOCKS - INTERLOCK



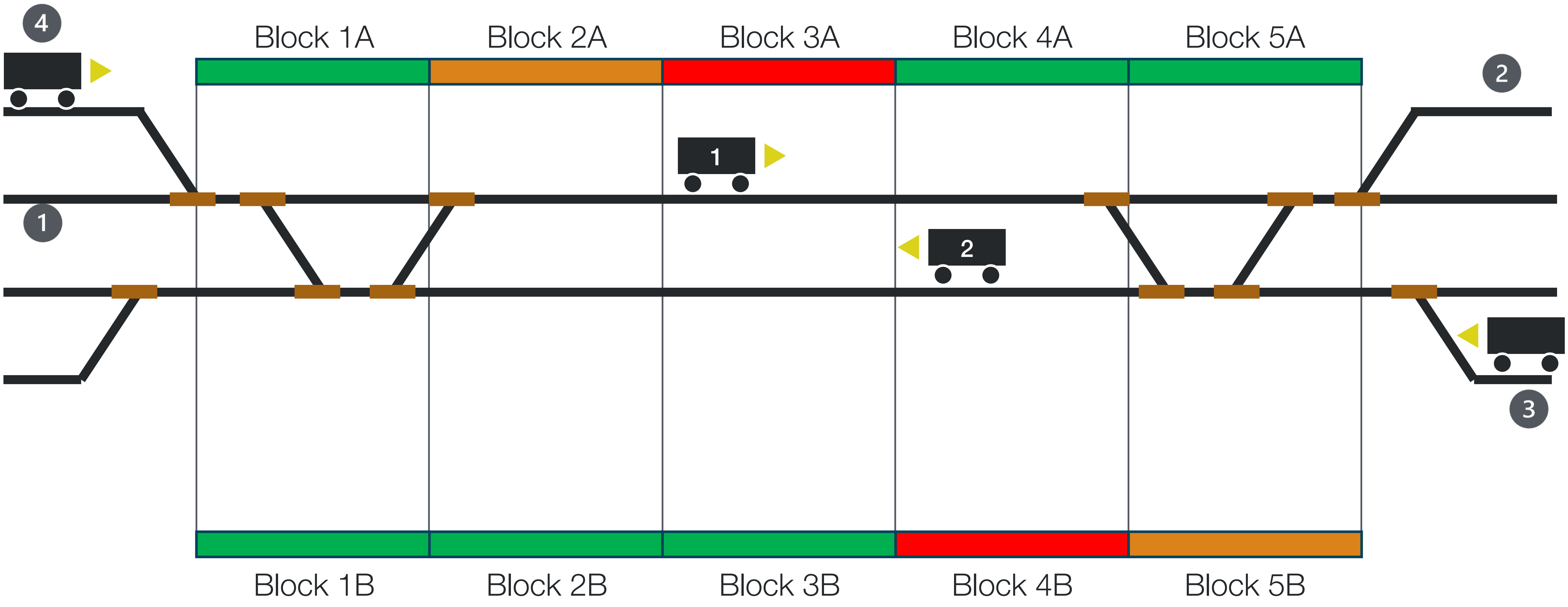
TRACK BLOCKS - INTERLOCK



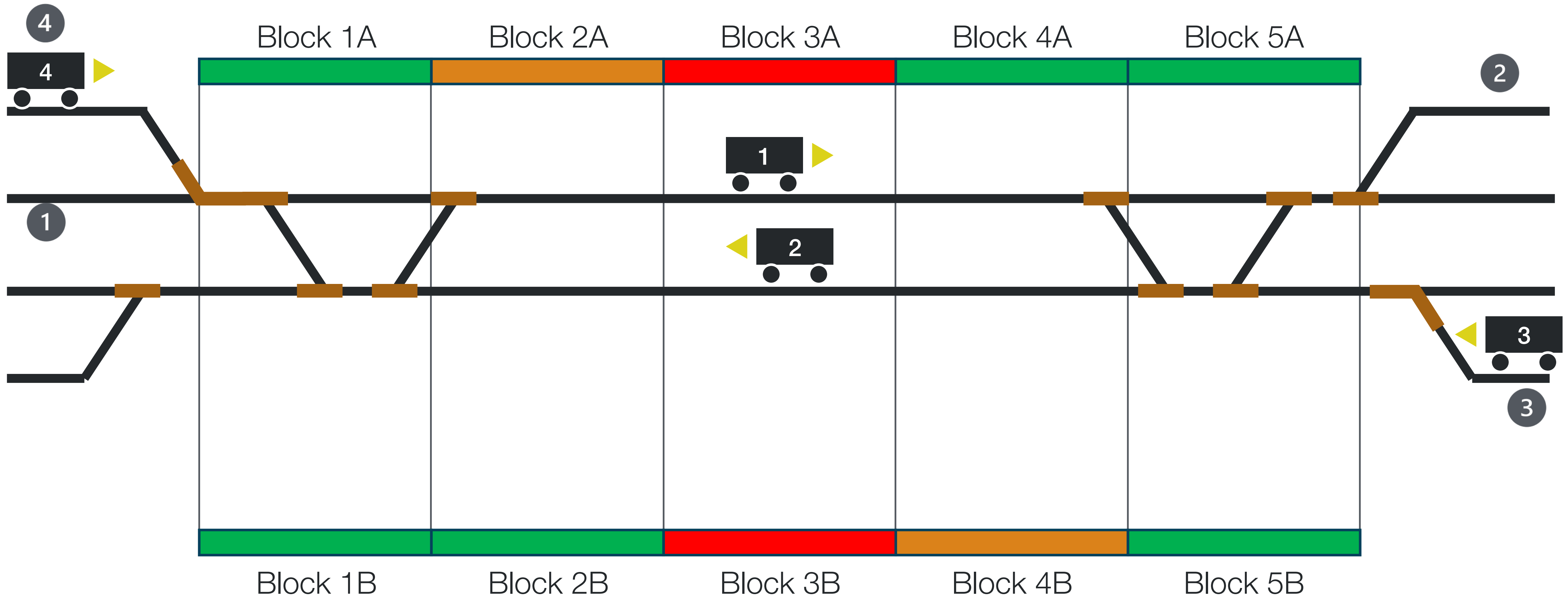
TRACK BLOCKS - INTERLOCK



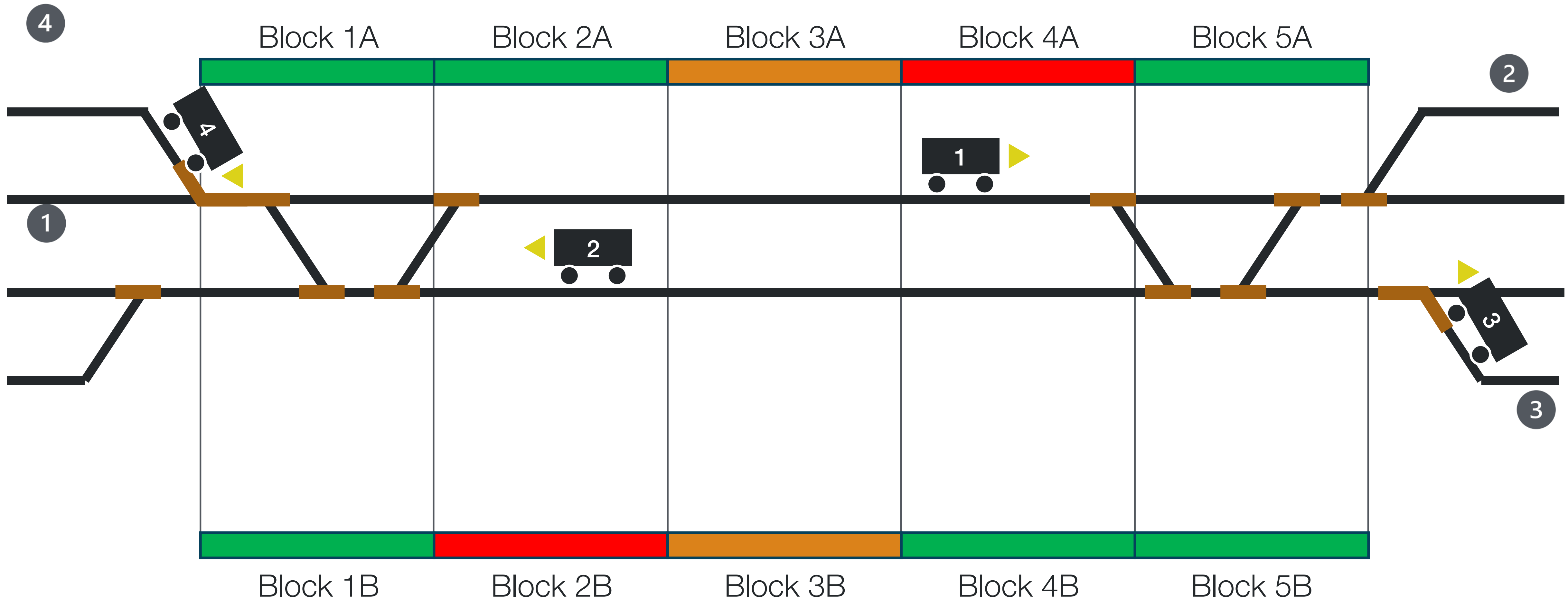
TRACK BLOCKS - INTERLOCK



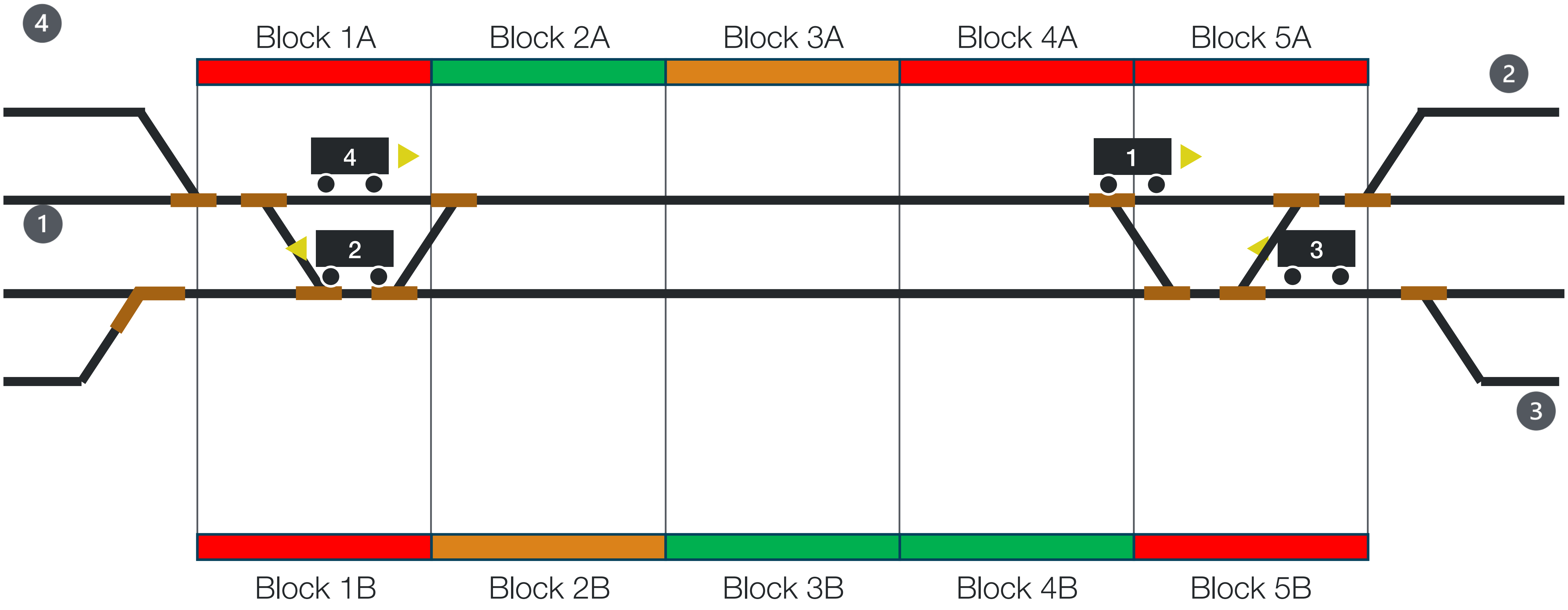
TRACK BLOCKS - INTERLOCK



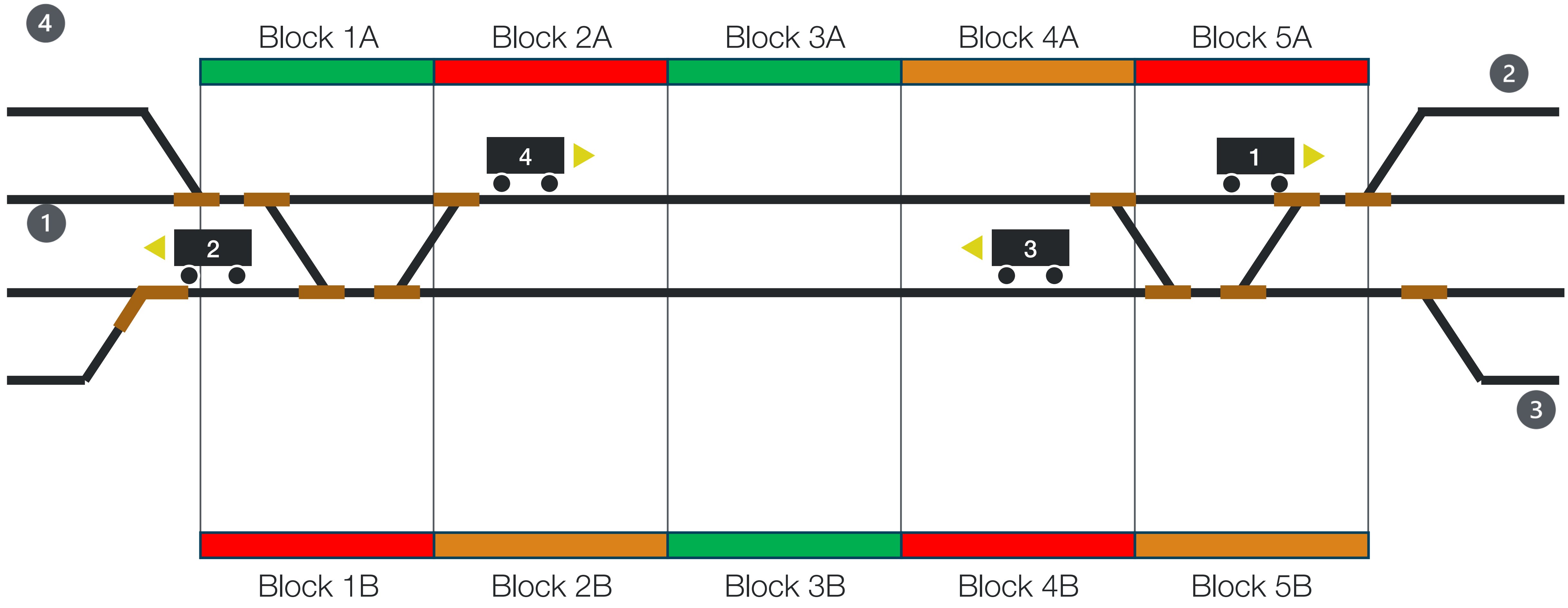
TRACK BLOCKS - INTERLOCK



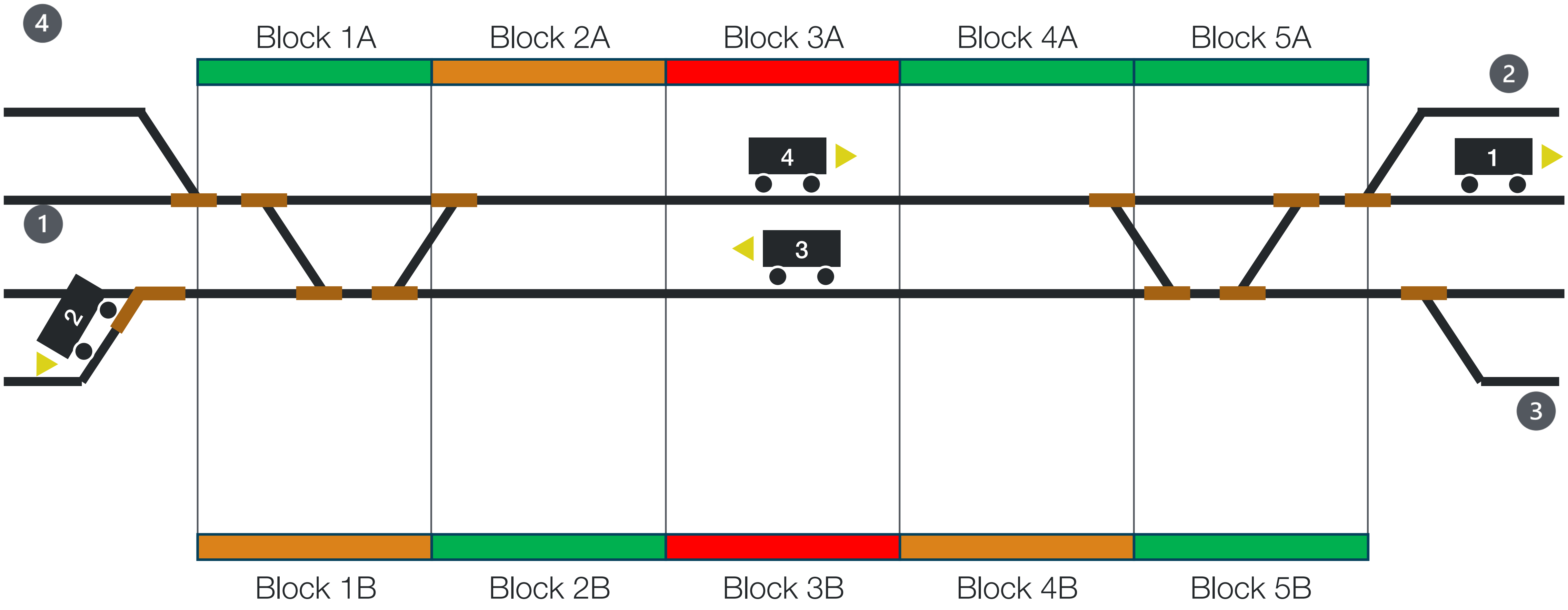
TRACK BLOCKS - INTERLOCK



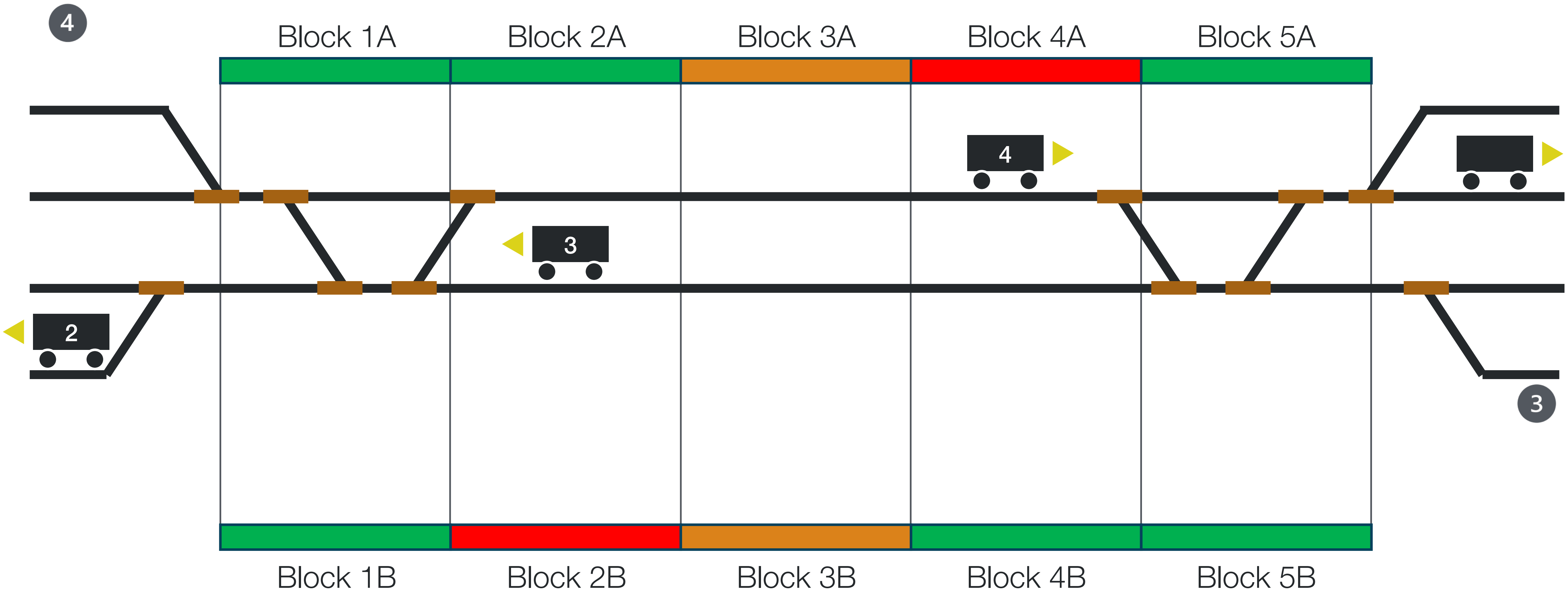
TRACK BLOCKS - INTERLOCK



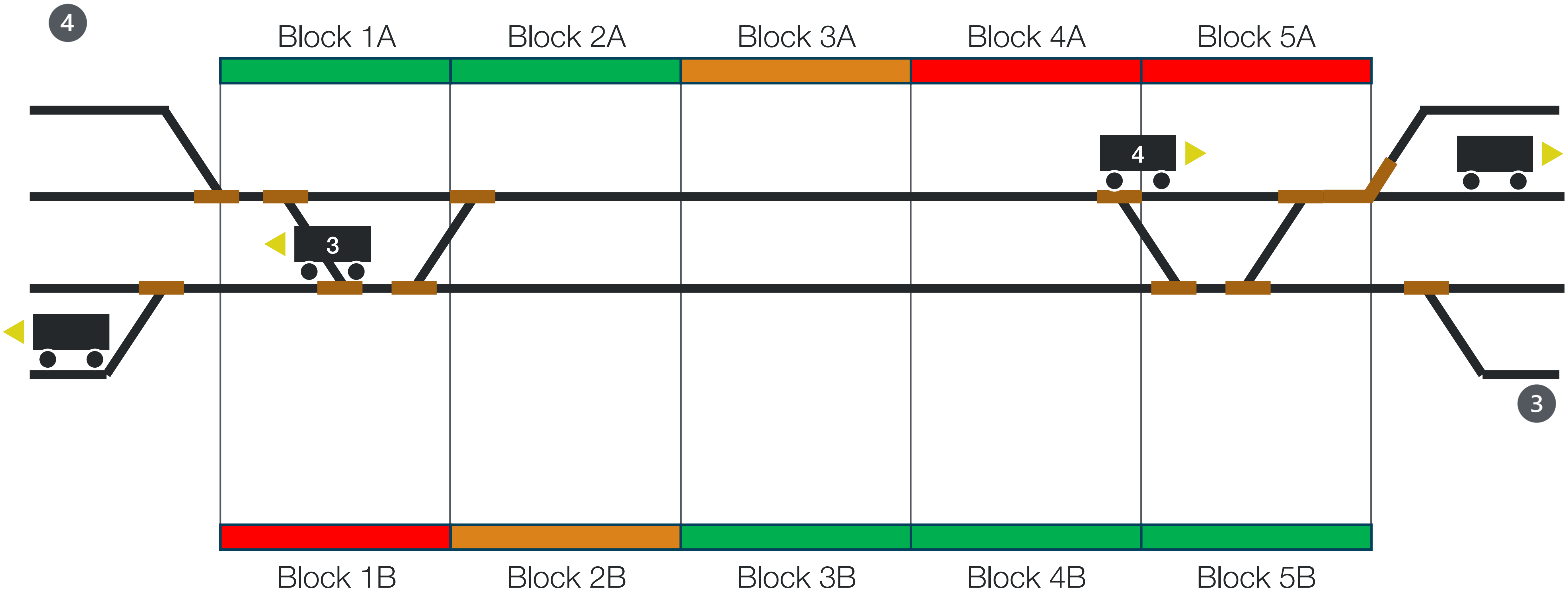
TRACK BLOCKS - INTERLOCK



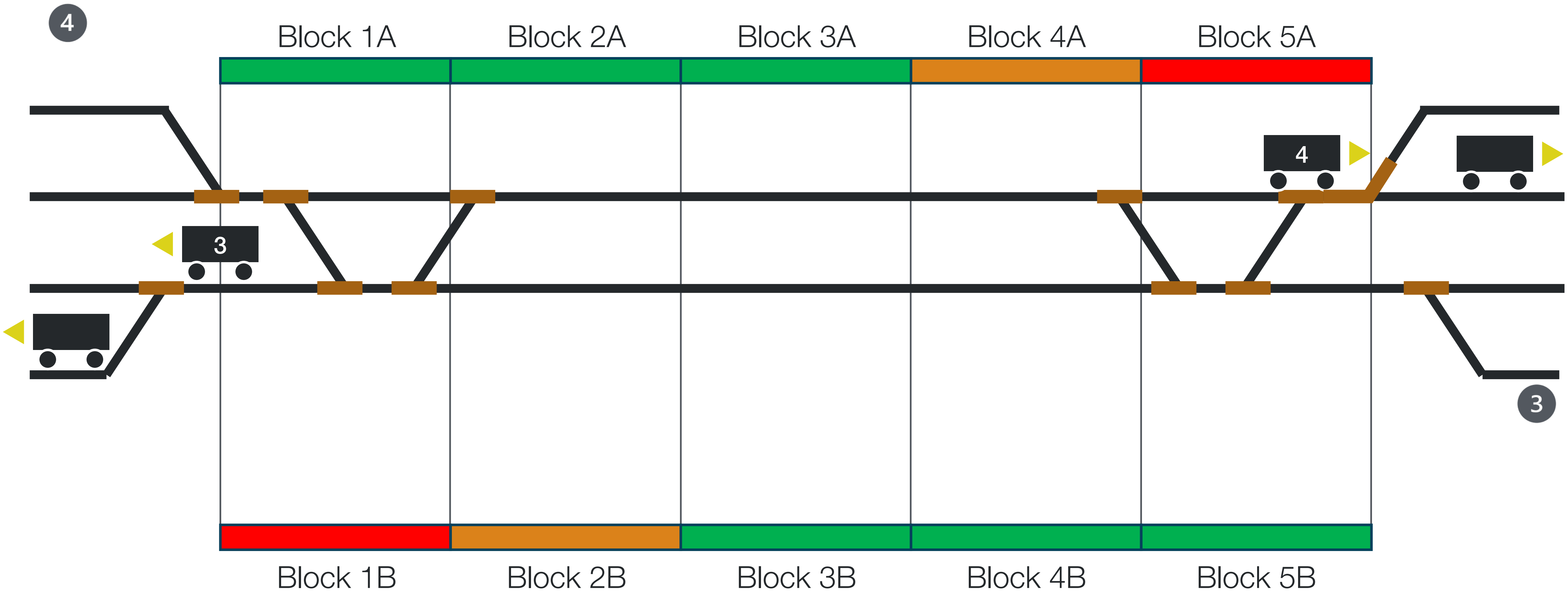
TRACK BLOCKS - INTERLOCK



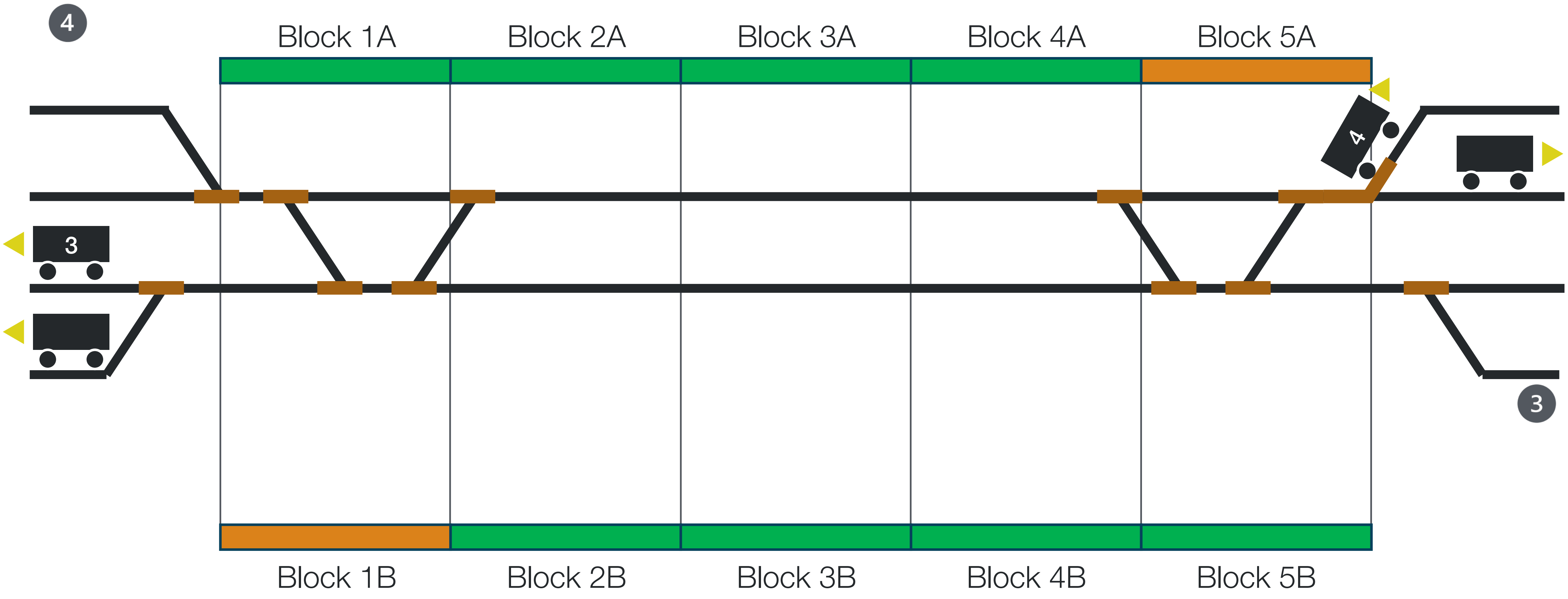
TRACK BLOCKS - INTERLOCK



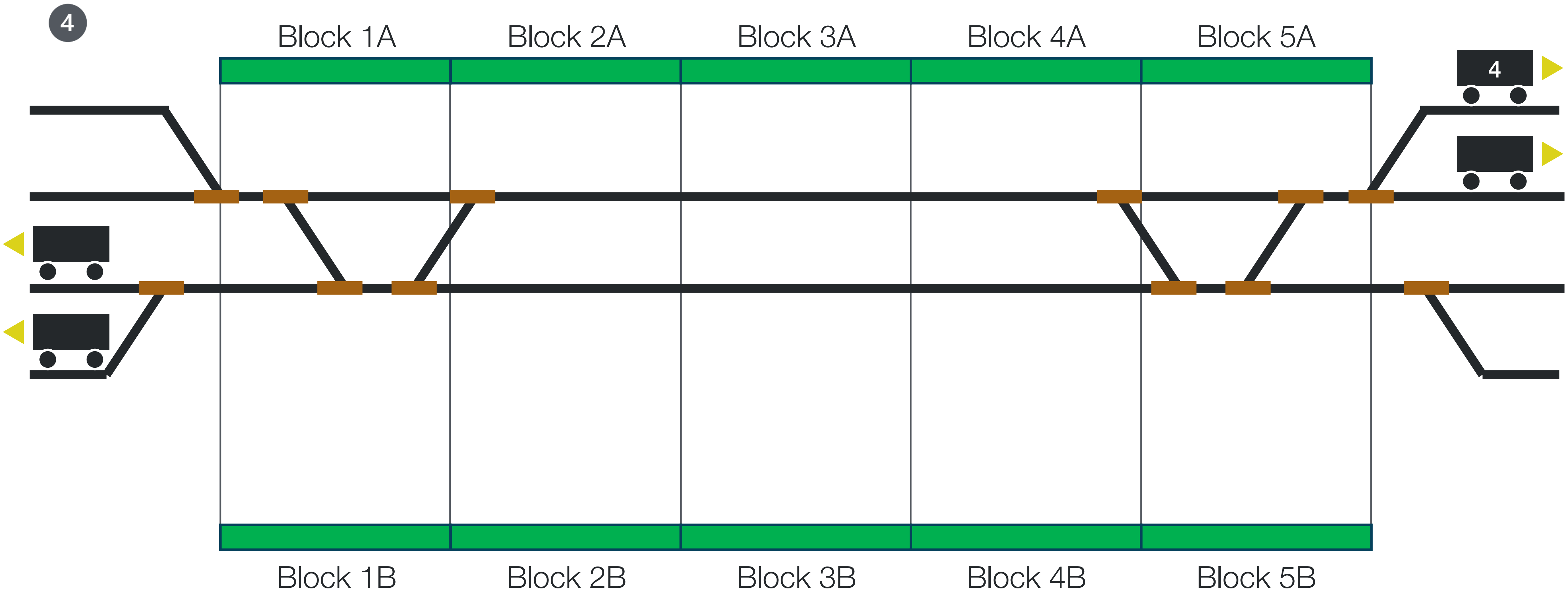
TRACK BLOCKS - INTERLOCK



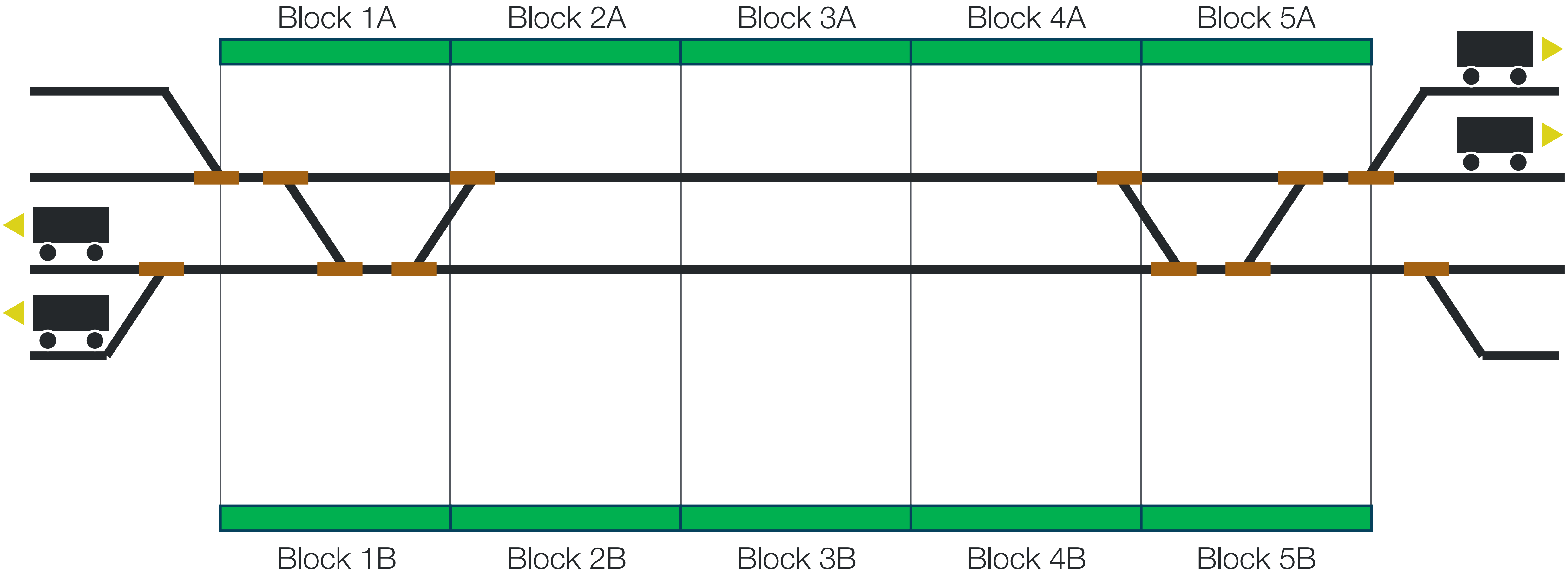
TRACK BLOCKS - INTERLOCK



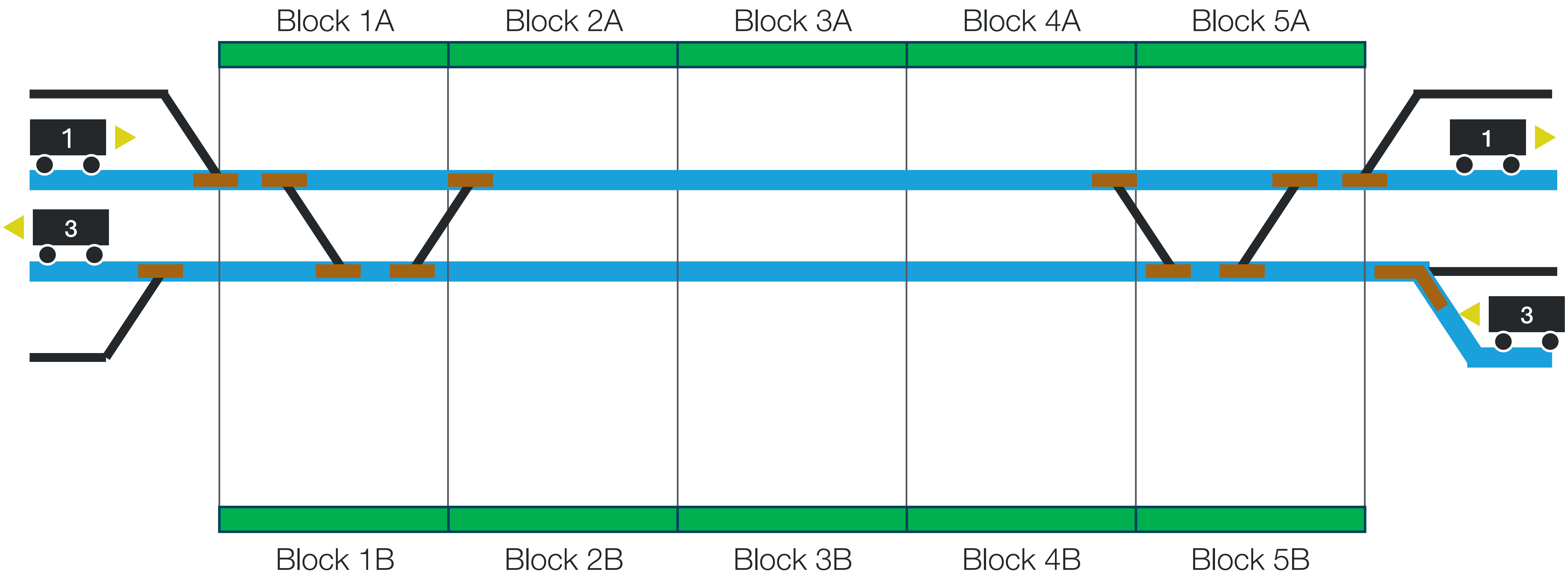
TRACK BLOCKS - INTERLOCK



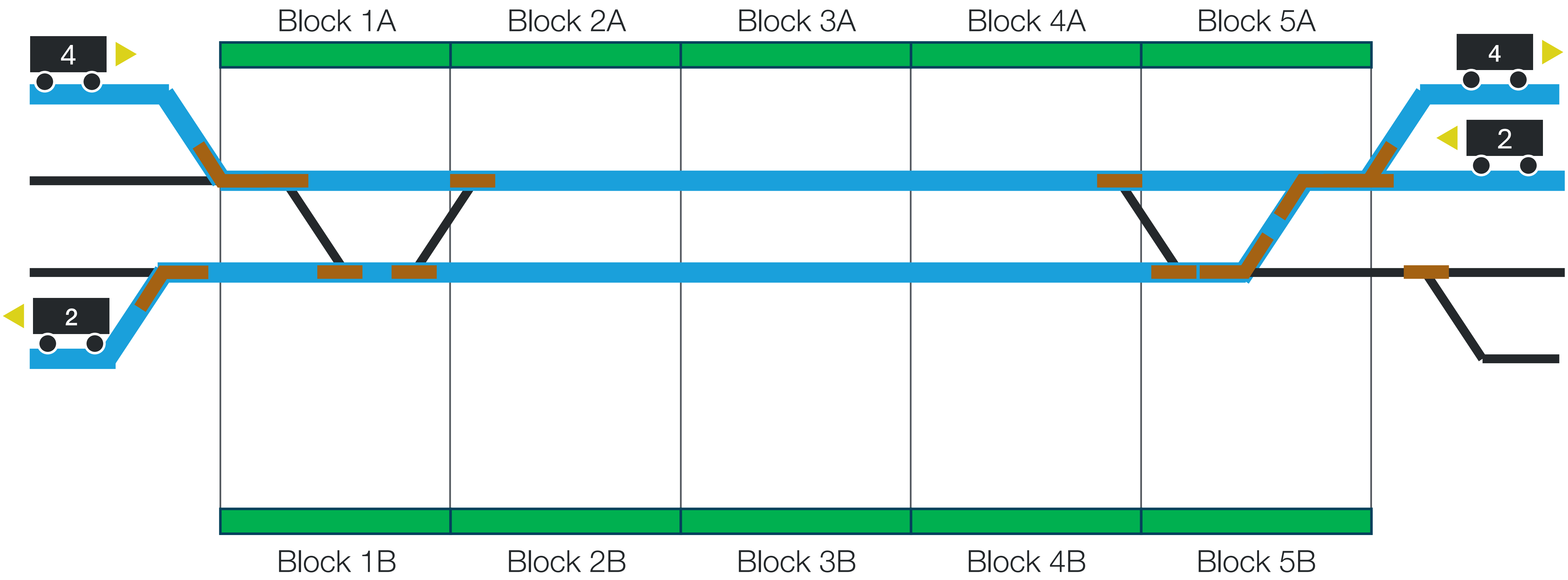
TRACK BLOCKS - INTERLOCK



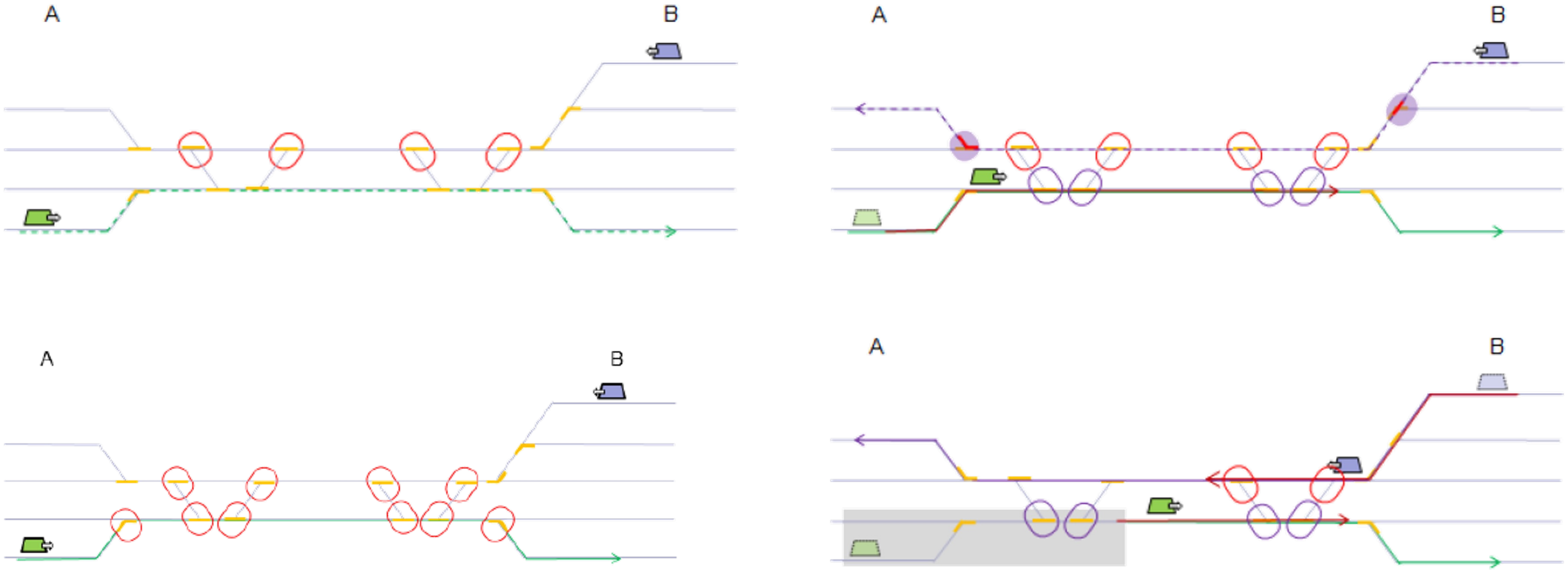
TRACK BLOCKS - INTERLOCK



TRACK BLOCKS - INTERLOCK

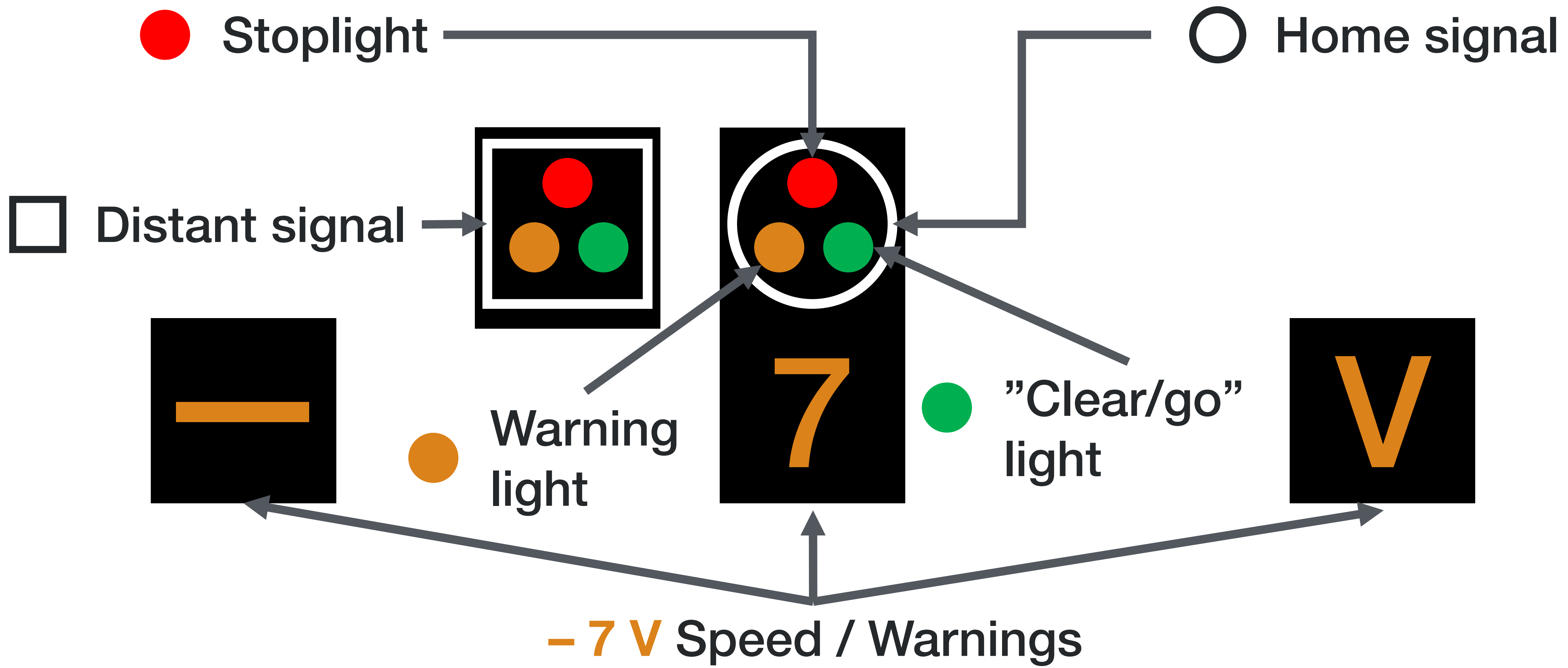


INTERLOCKING



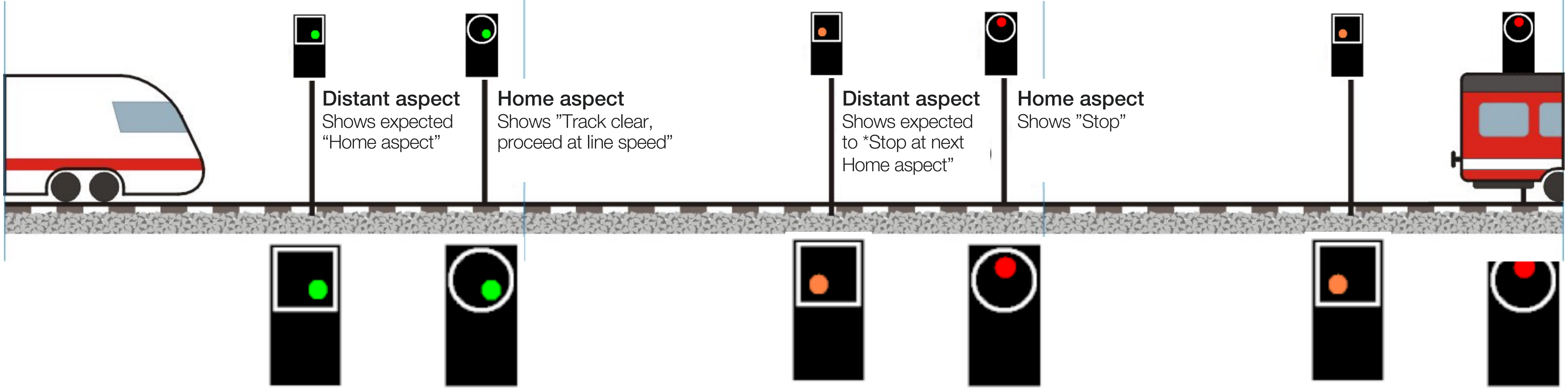
EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



LEGACY SYSTEM – SIMPLE SCHEMATICS

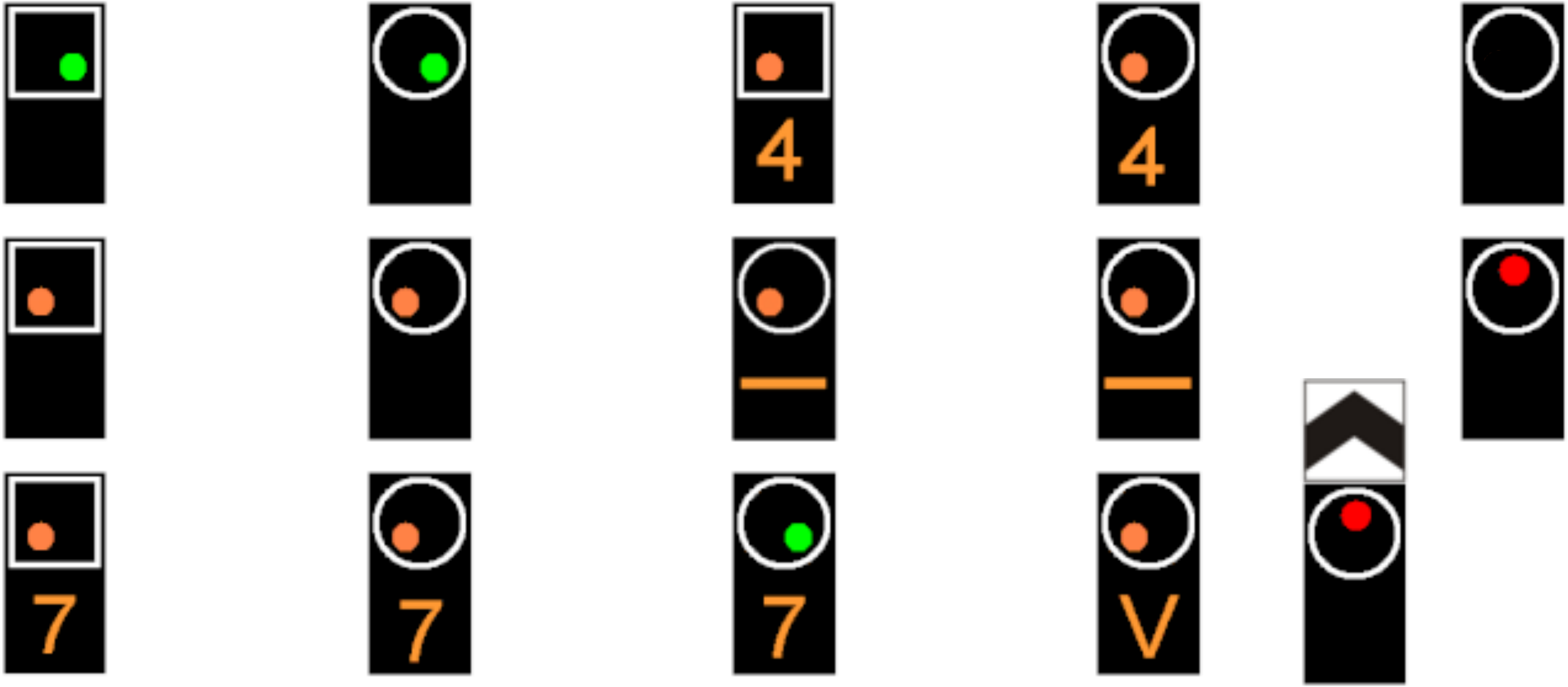
1. Track block occupied
2. Track block clear (free)
3. Track block occupied



By The original uploader, Sansc#/0**e at German Wikipedia.

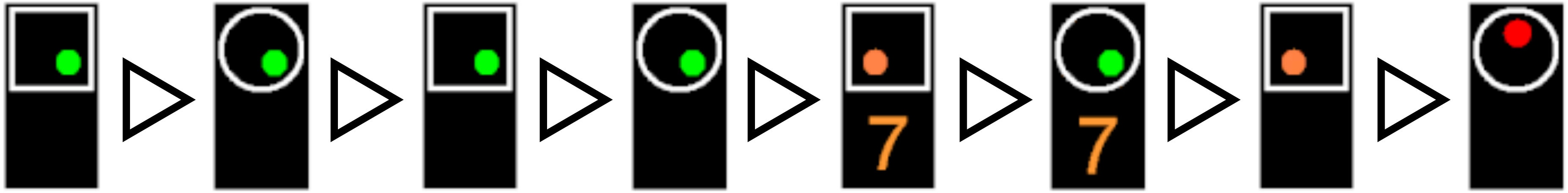
EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



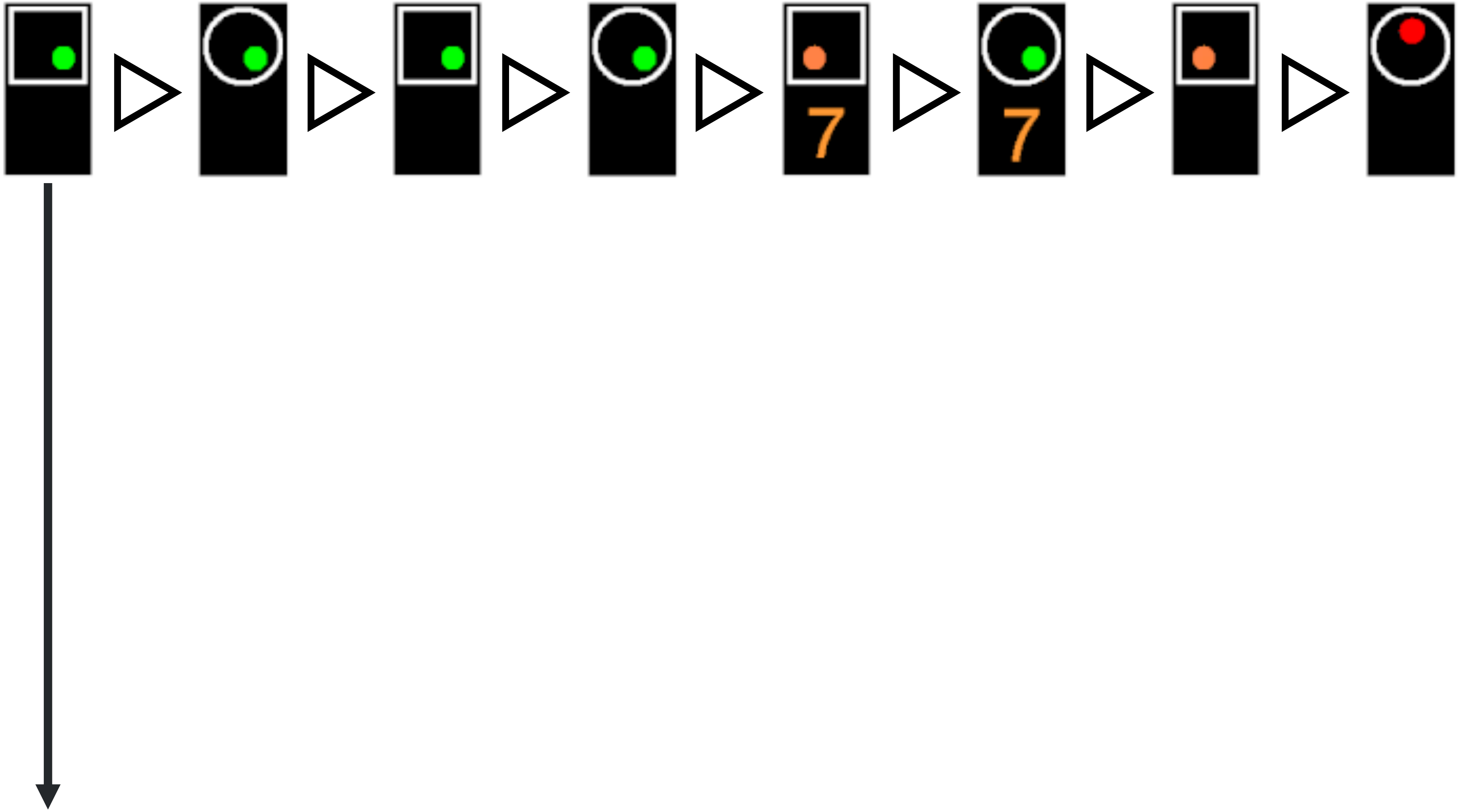
EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



EXAMPLE OF SIGNALING IN SWITZERLAND

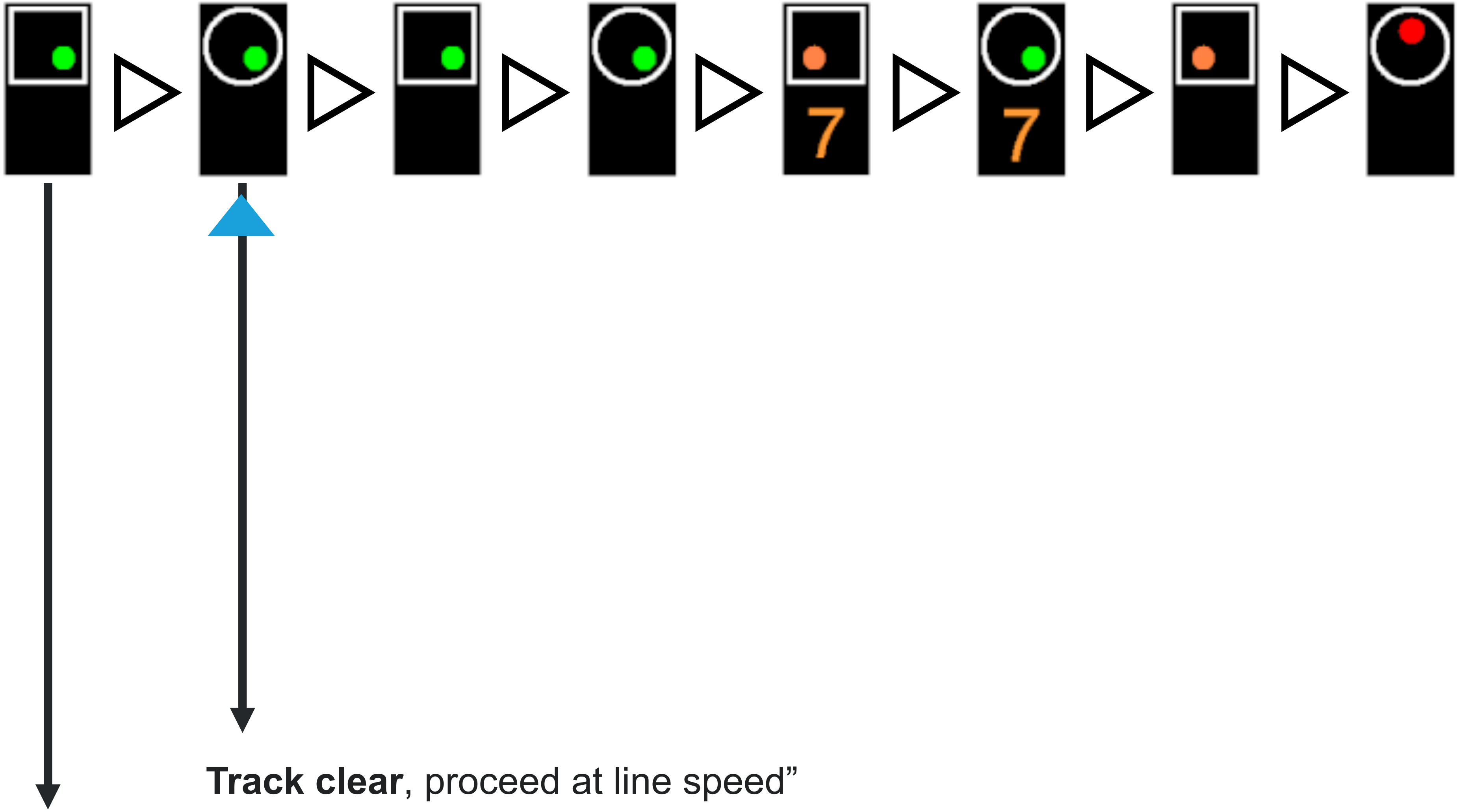
TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



Next is “Track clear”, proceed at line speed”

EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS

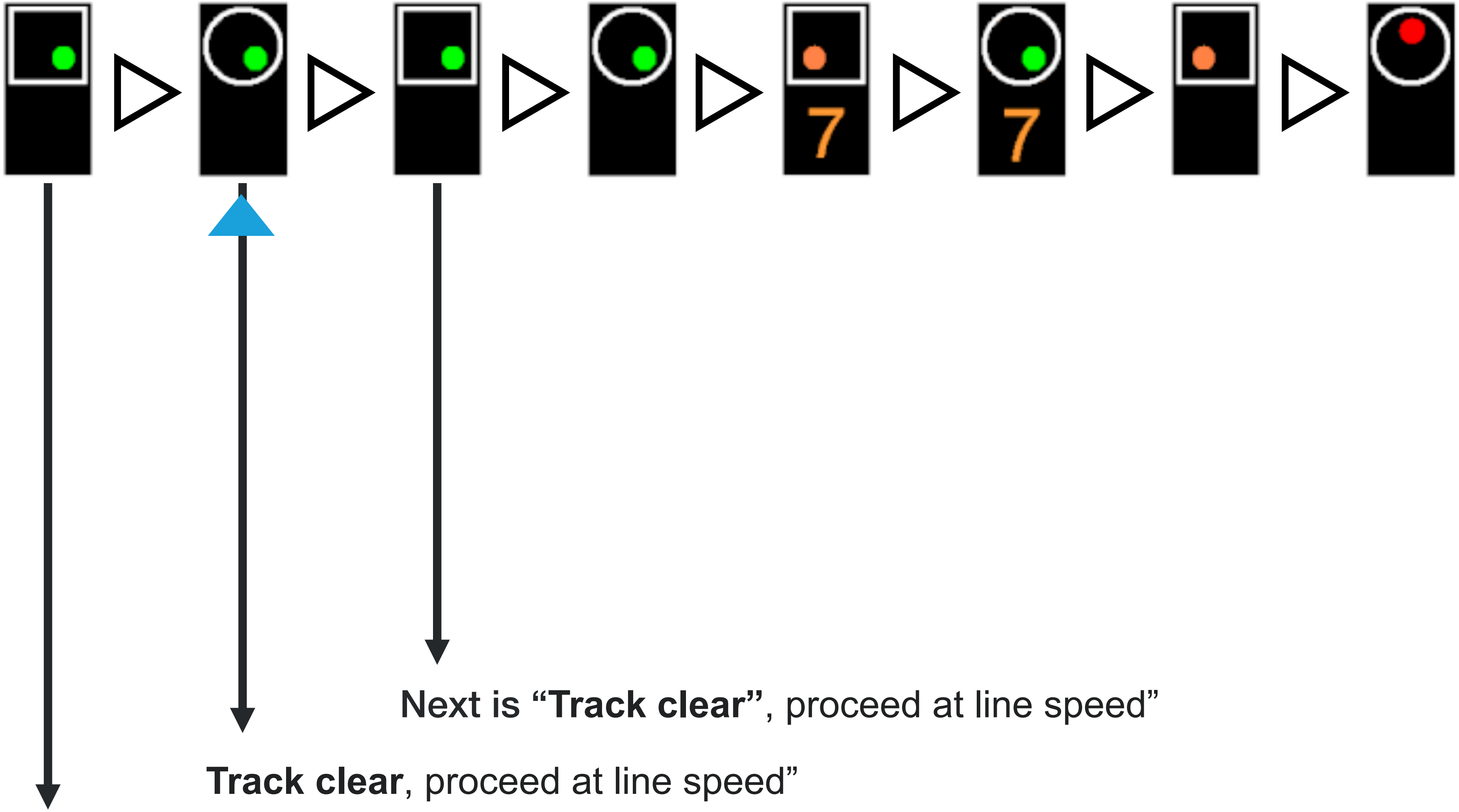


Track clear, proceed at line speed”

Next is “Track clear”, proceed at line speed”

EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



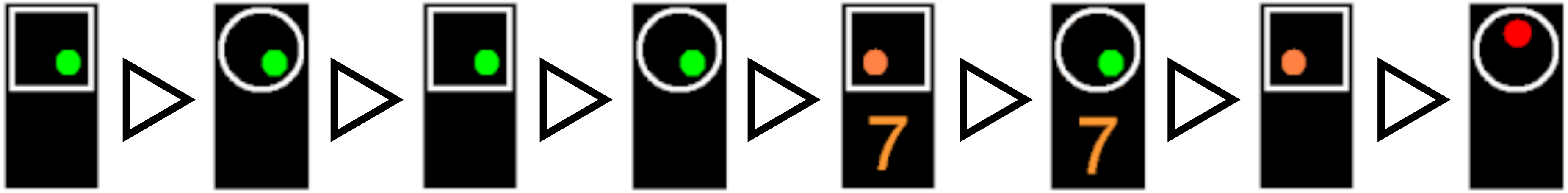
Next is “**Track clear**”, proceed at line speed”

Track clear, proceed at line speed”

Next is “**Track clear**”, proceed at line speed”

EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



Track clear, proceed at line speed”

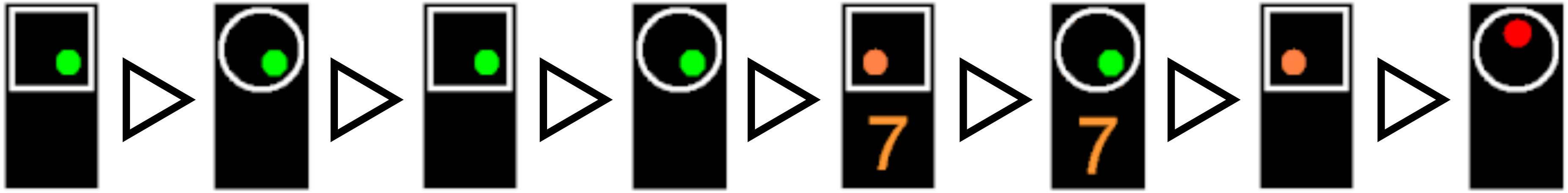
Next is **“Track clear”**, proceed at line speed”

Track clear, proceed at line speed”

Next is **“Track clear”**, proceed at line speed”

EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



Next is “**Speed restriction**”, proceed at line speed”

Track clear, proceed at line speed”

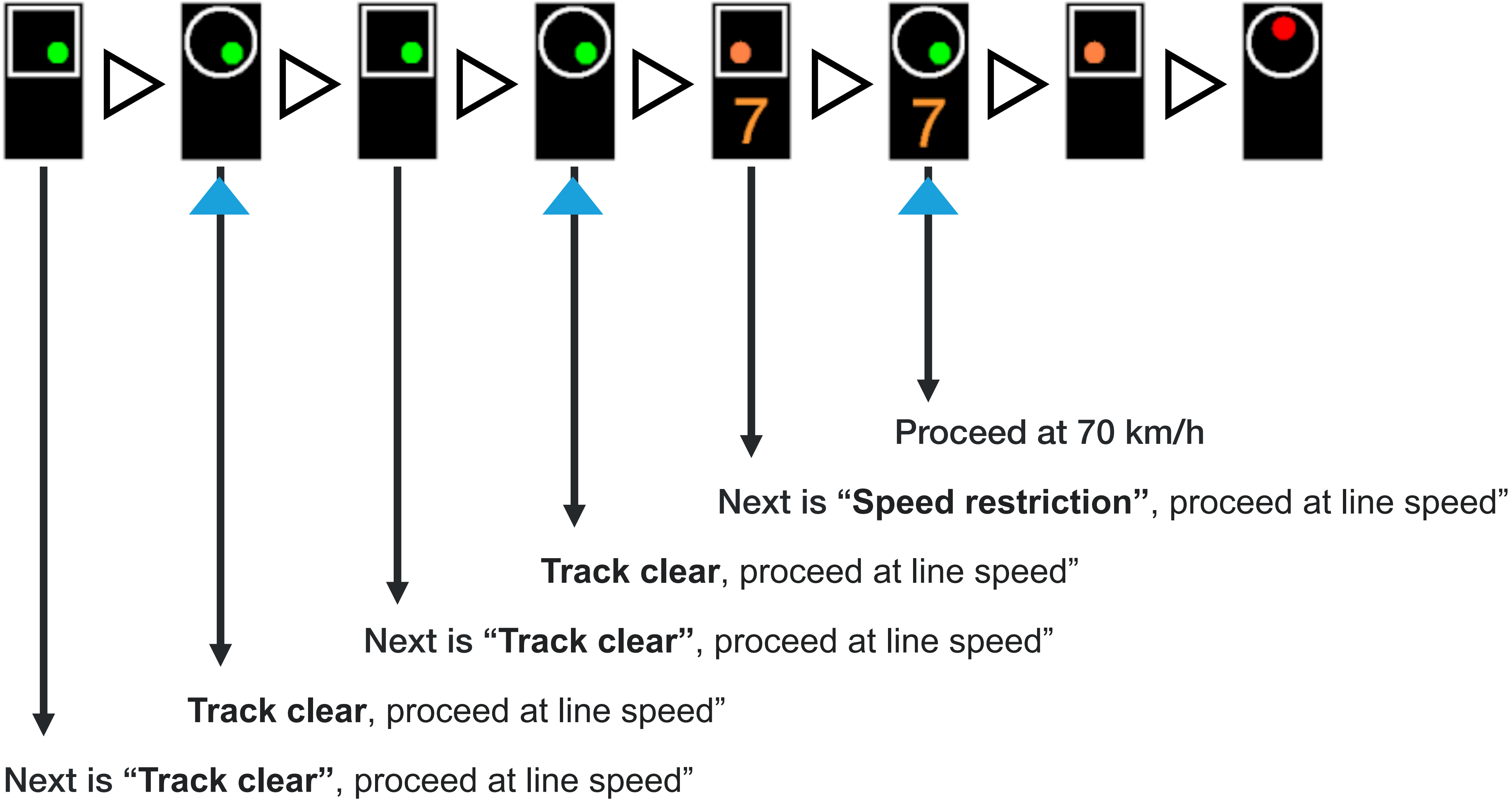
Next is “**Track clear**”, proceed at line speed”

Track clear, proceed at line speed”

Next is “**Track clear**”, proceed at line speed”

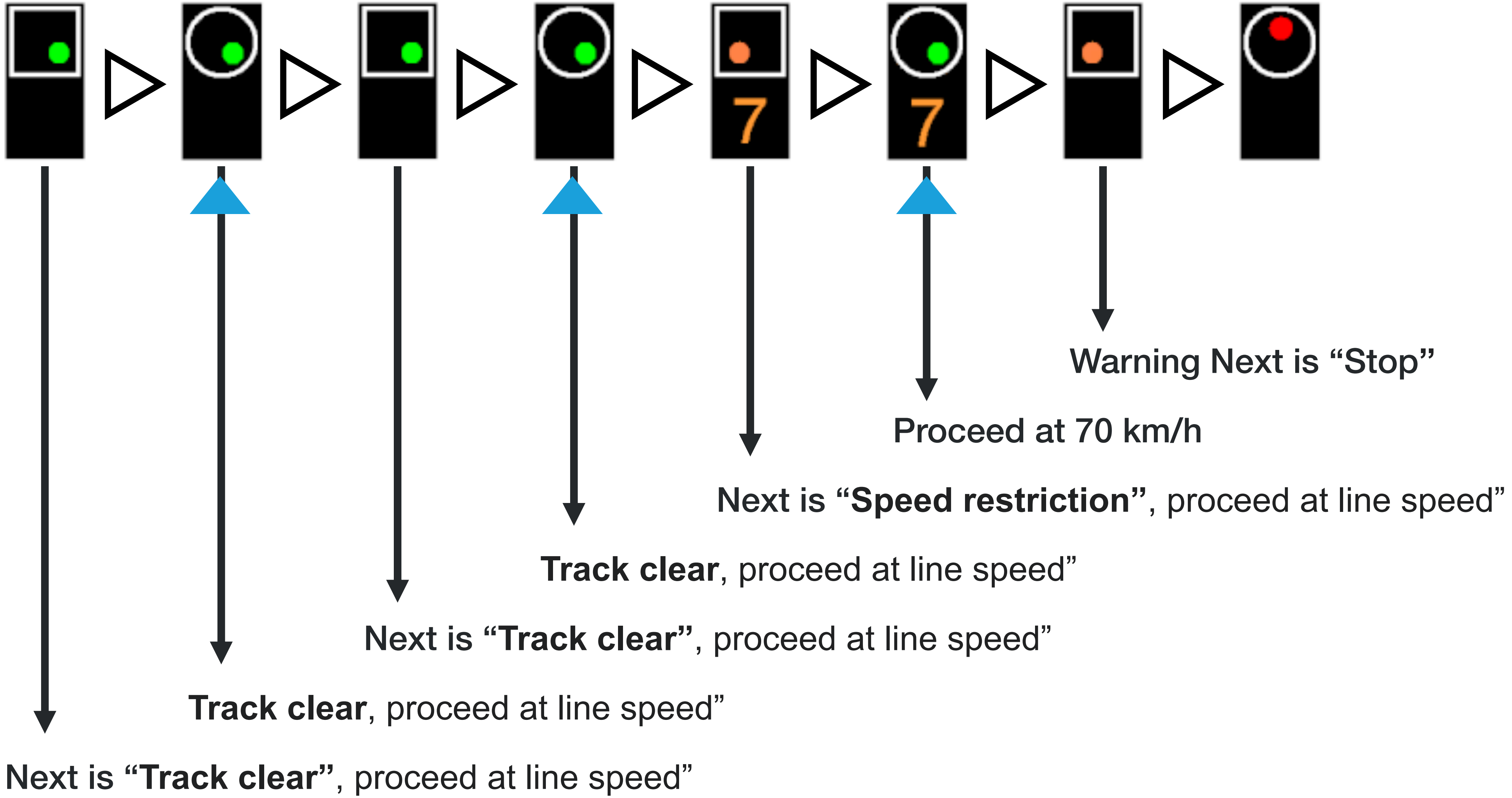
EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



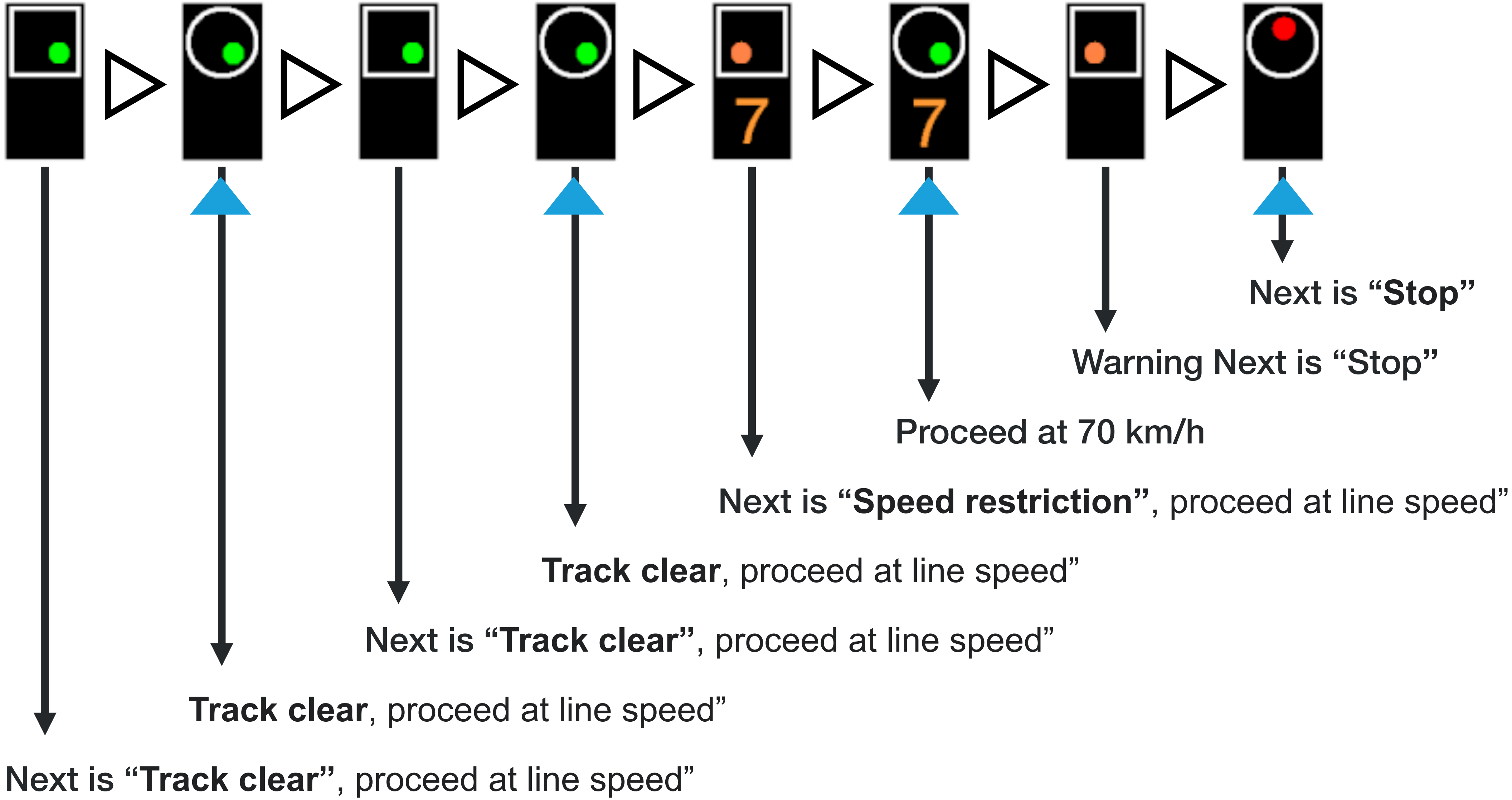
EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS

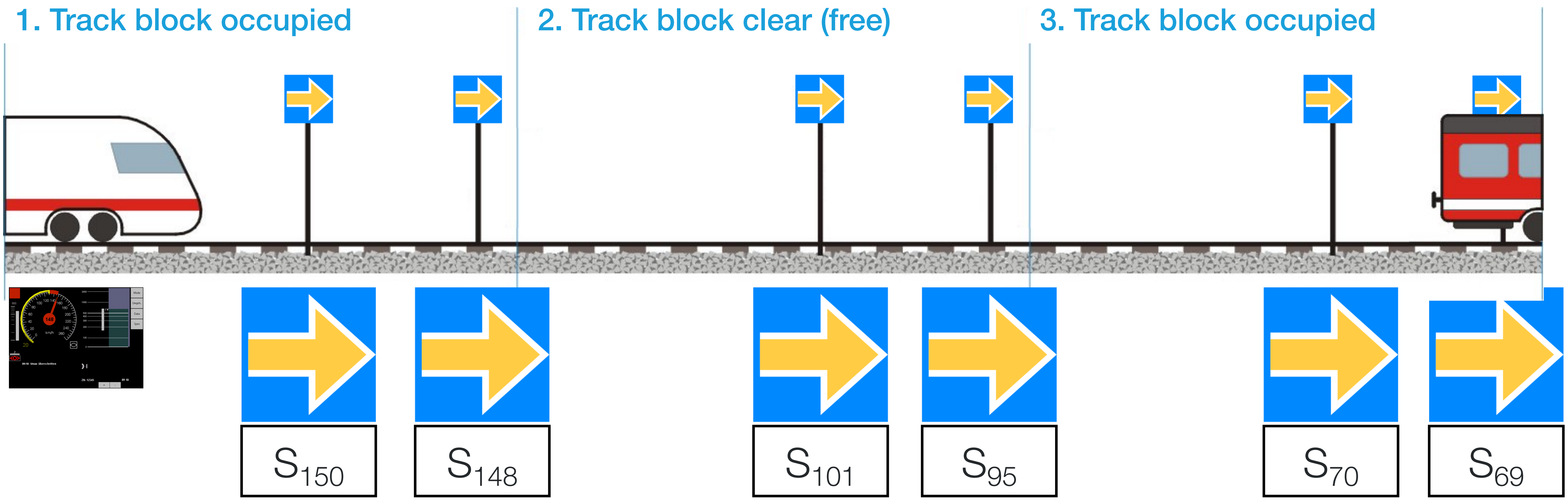


EXAMPLE OF SIGNALING IN SWITZERLAND

TYPE N SIGNALS – MAINLY USED ON CORE AXES WITHOUT ETCS BY SBB AND BLS



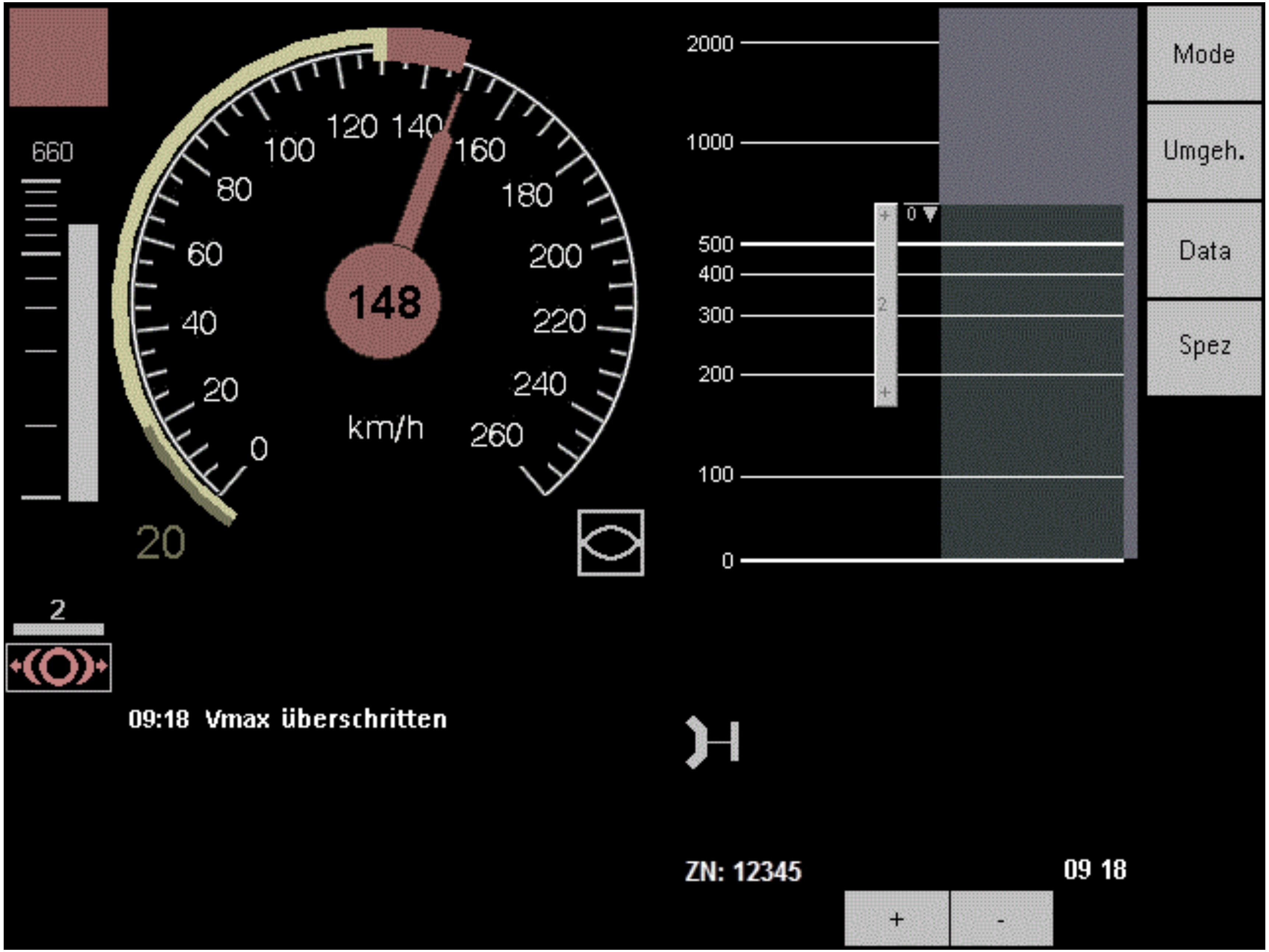
ETCS – SIMPLE SCHEMATICS



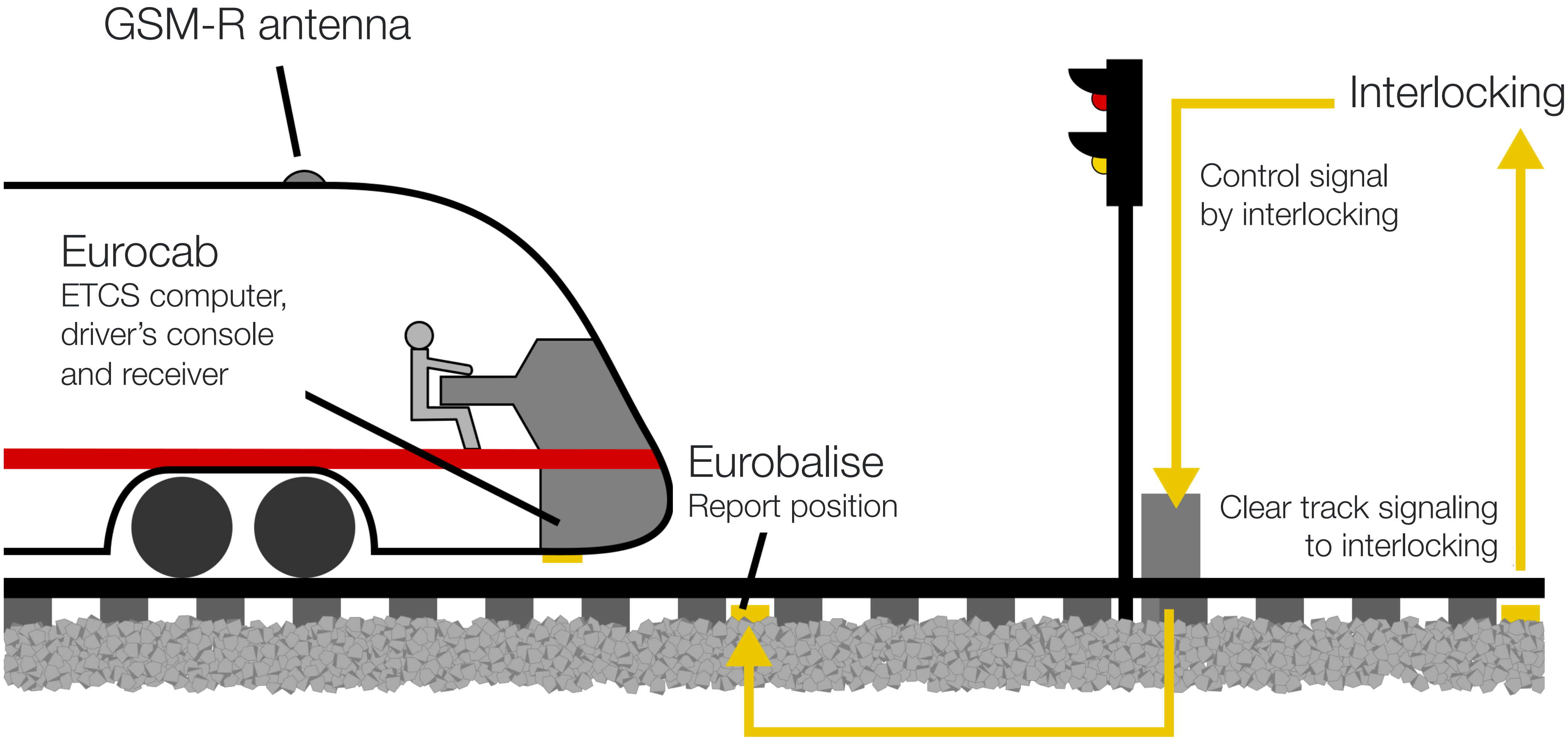
ETCS Stop Markers

By The original uploader, Sansc#/0**e at German Wikipedia.

ETCS – DRIVER'S INDICATION

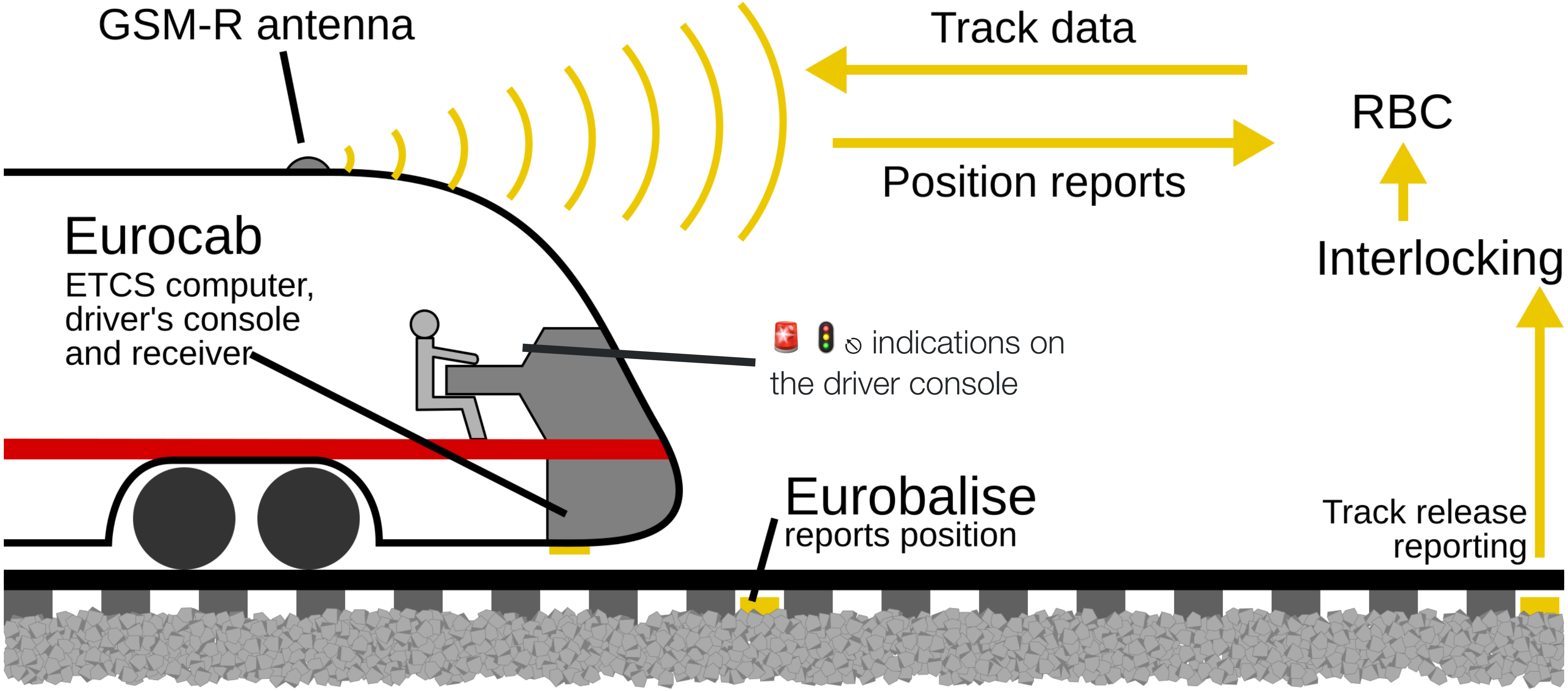


ETCS – L1 SIMPLE SCHEMATICS



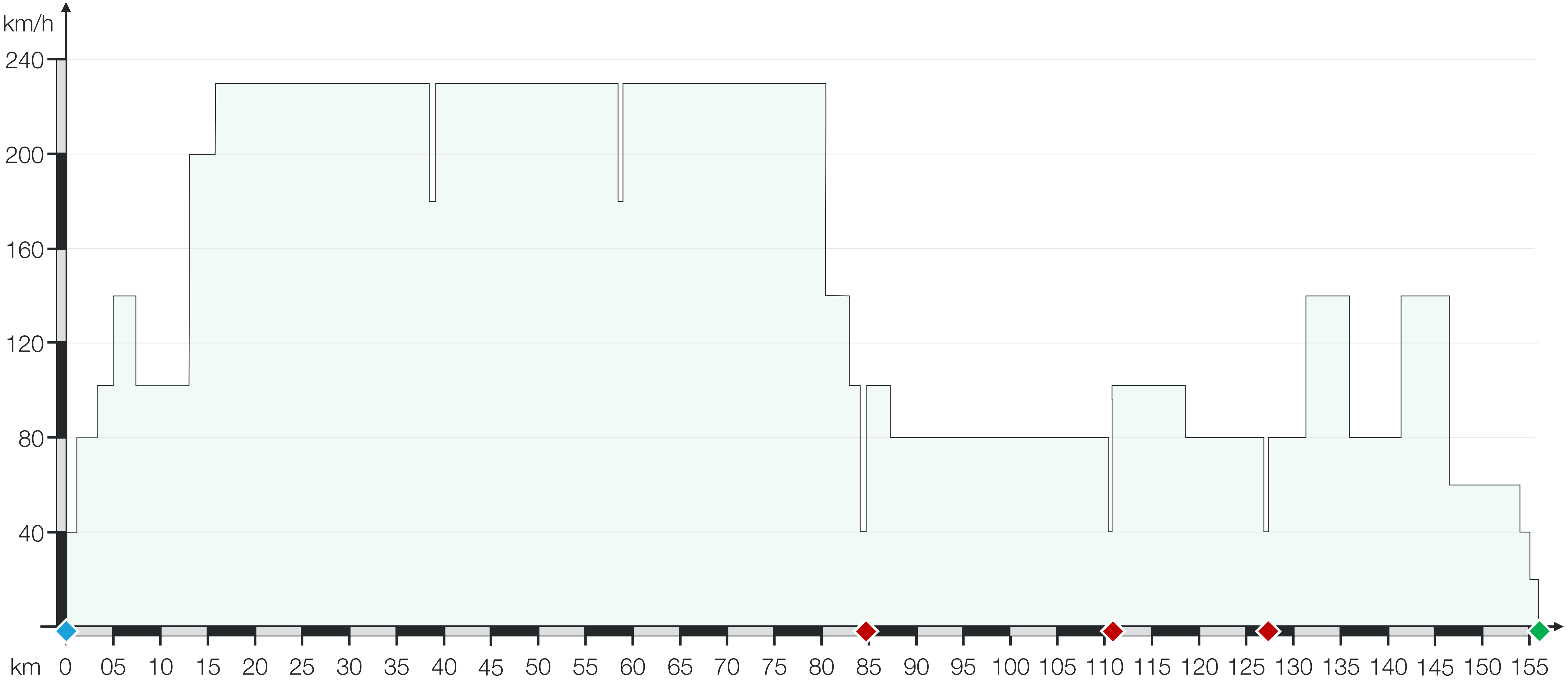
By The original uploader, Sansc#/0**e at German Wikipedia.

ETCS – L2 SIMPLE SCHEMATICS

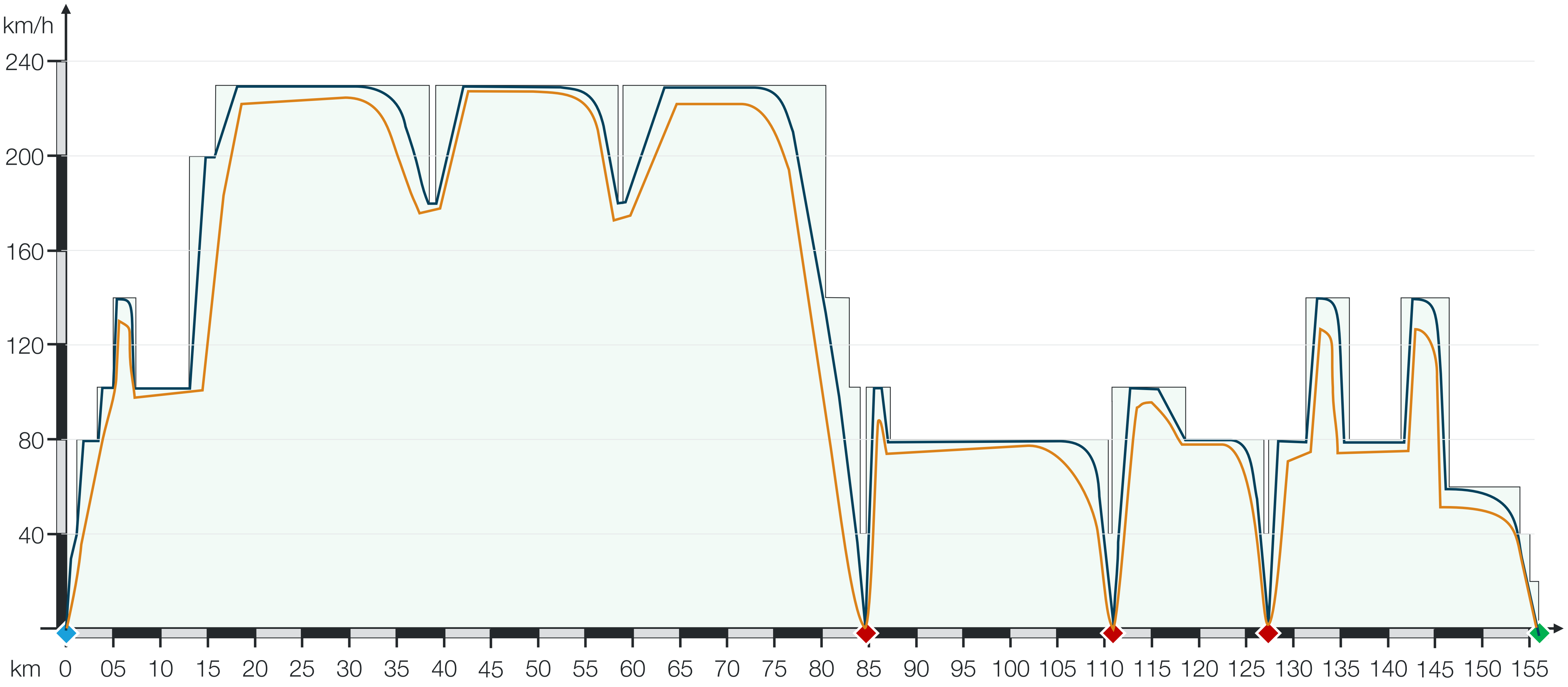


By The original upload

MAX SPEED LIMITS



SPEED PROFILES

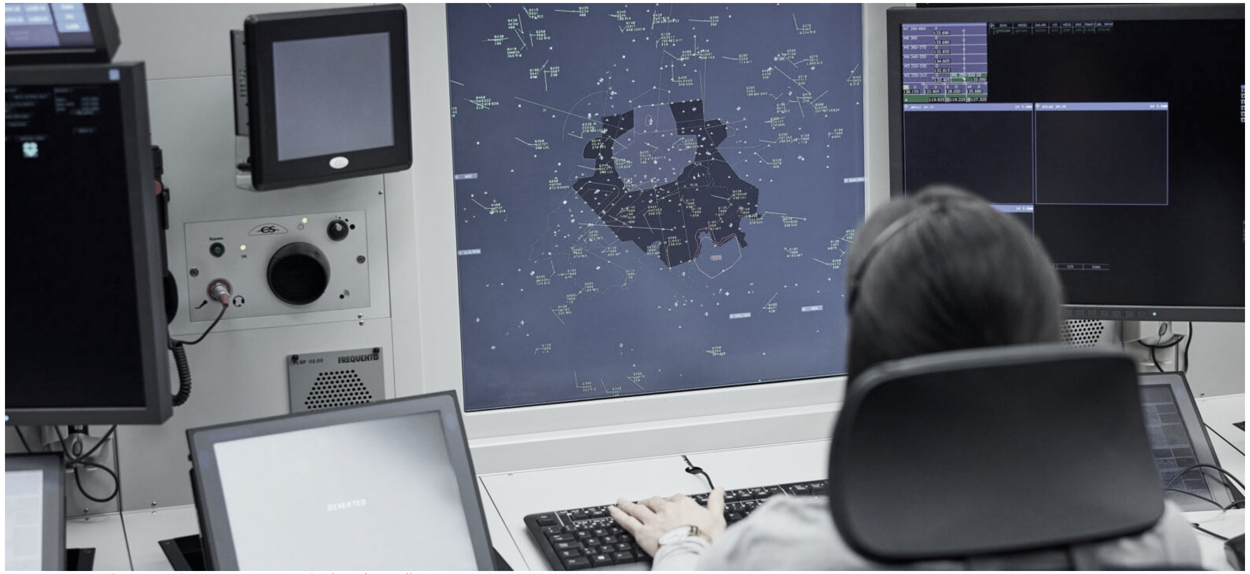


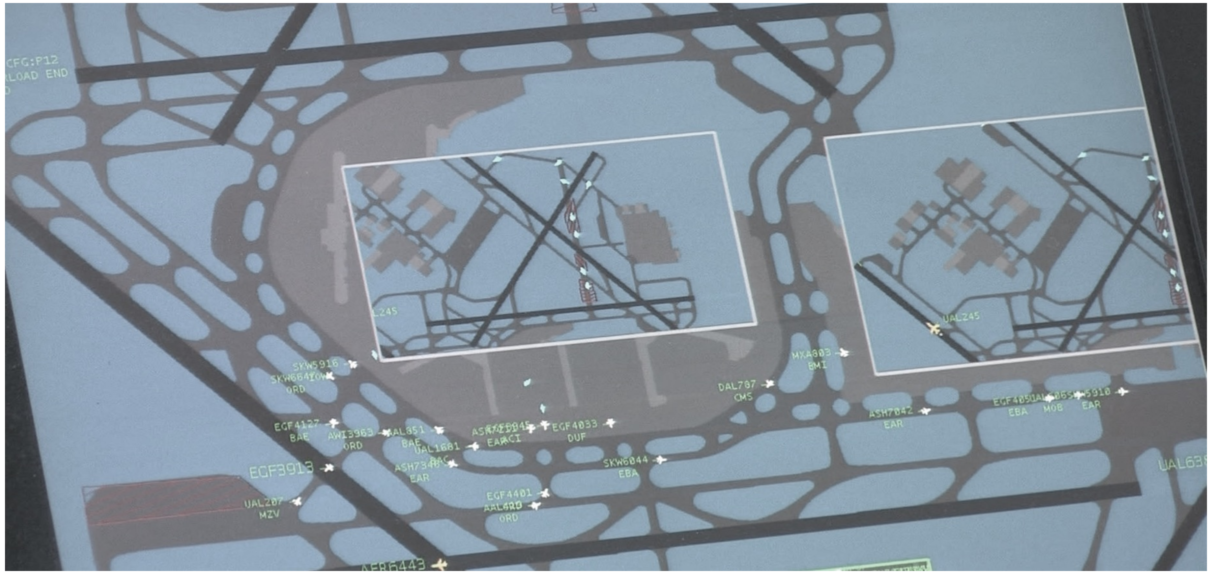
ATC AND AICRAFT-2-AIRCRAFT COM

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

CONTROL CENTERS – ATC (ANSP)

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

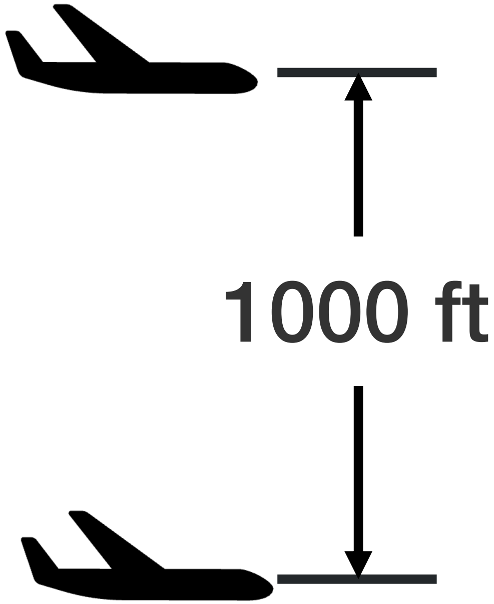




VERTICAL SEPARATION

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

Vertical Separation: ICAO specifies minimum vertical separation for IFR flight as 1000 ft (300 m) below FL290 and 2000 ft (600 m) above FL290, except where Reduced Vertical Separation Minima (RVSM) apply.

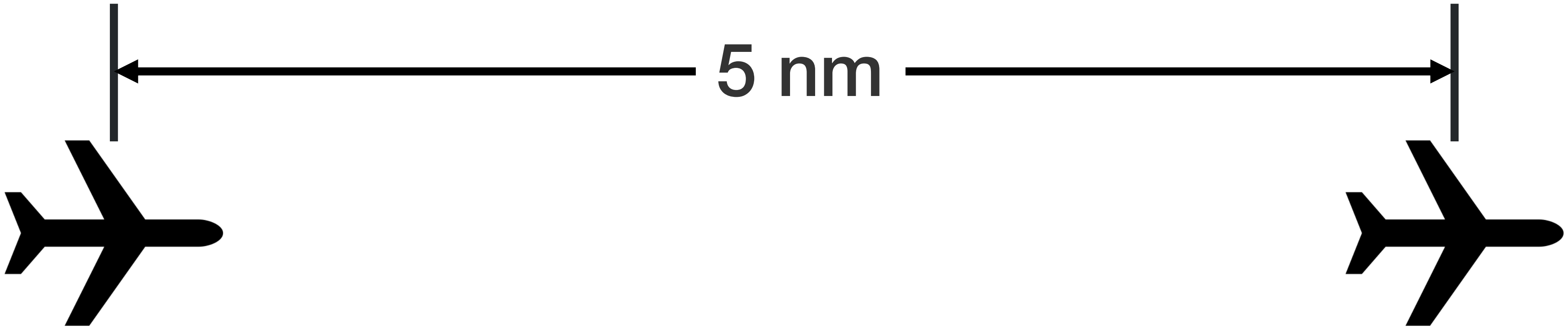


Reference:

LONGITUDINAL SEPARATION

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

Longitudinal Separation: Longitudinal separation is applied so that the spacing between aircraft is never less than a specified amount (with ATC).

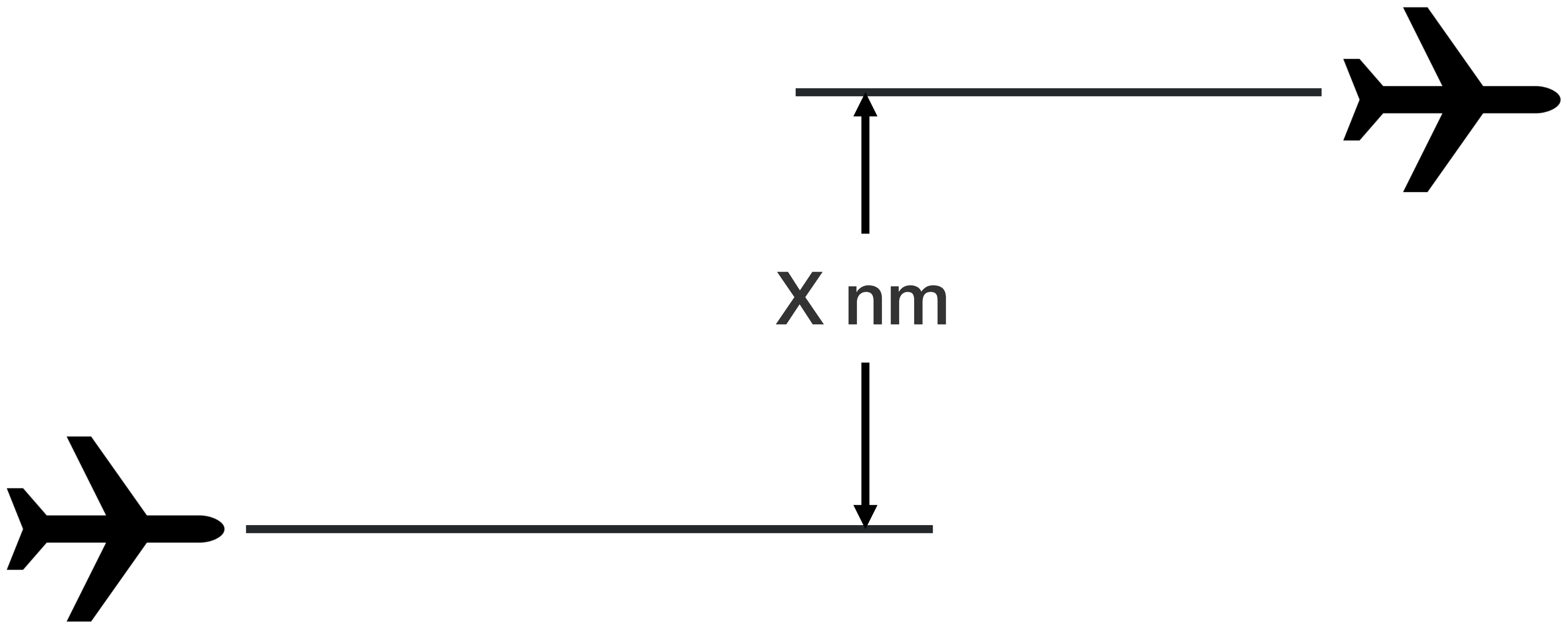


Reference:

LATERAL SEPARATION

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

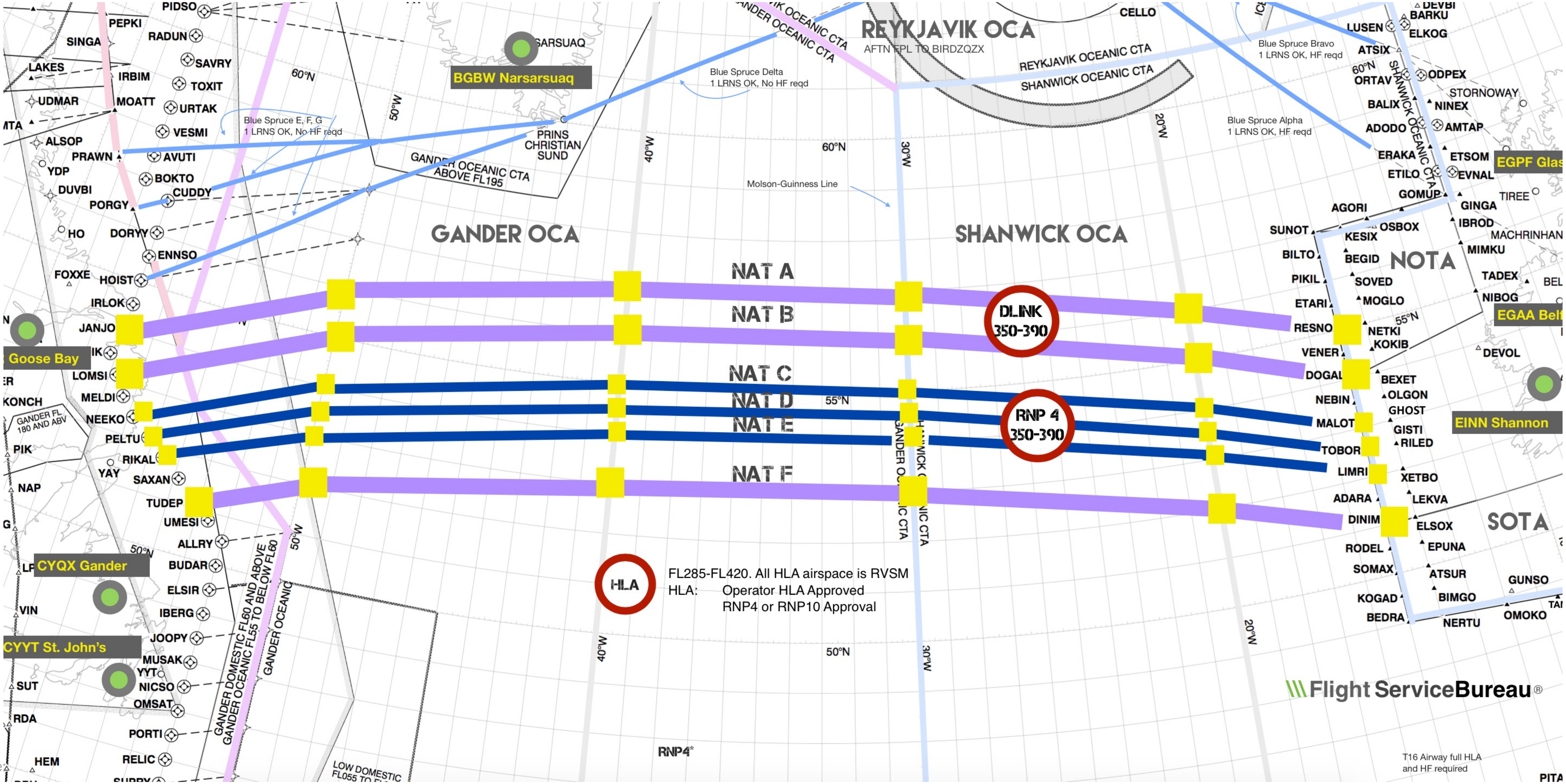
Lateral Separation: Lateral separation is applied so that the spacing between aircraft is never less than a specified amount (with ATC, given according to routes and approaches/departures procedures).



Reference:

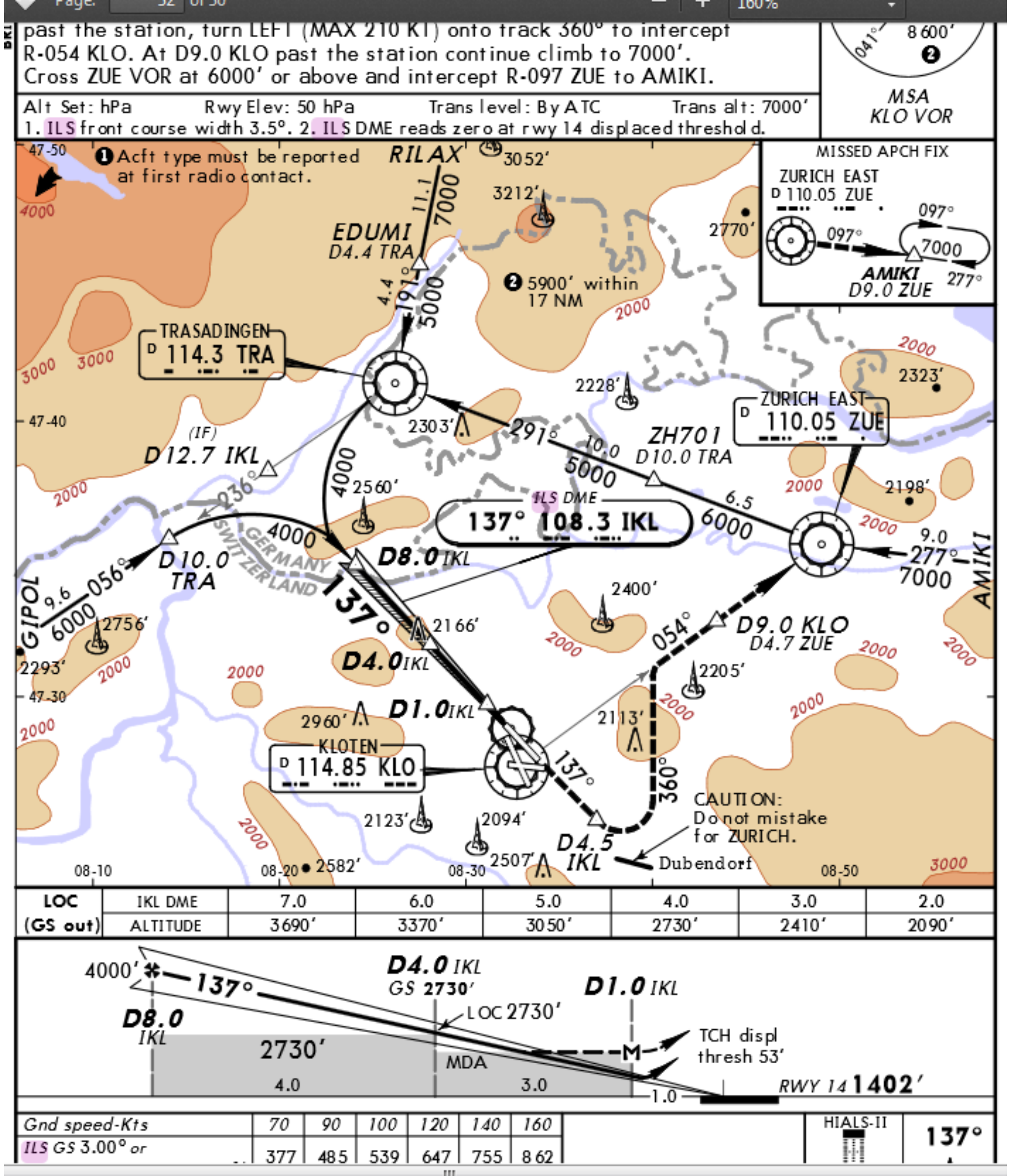
TRACKS

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



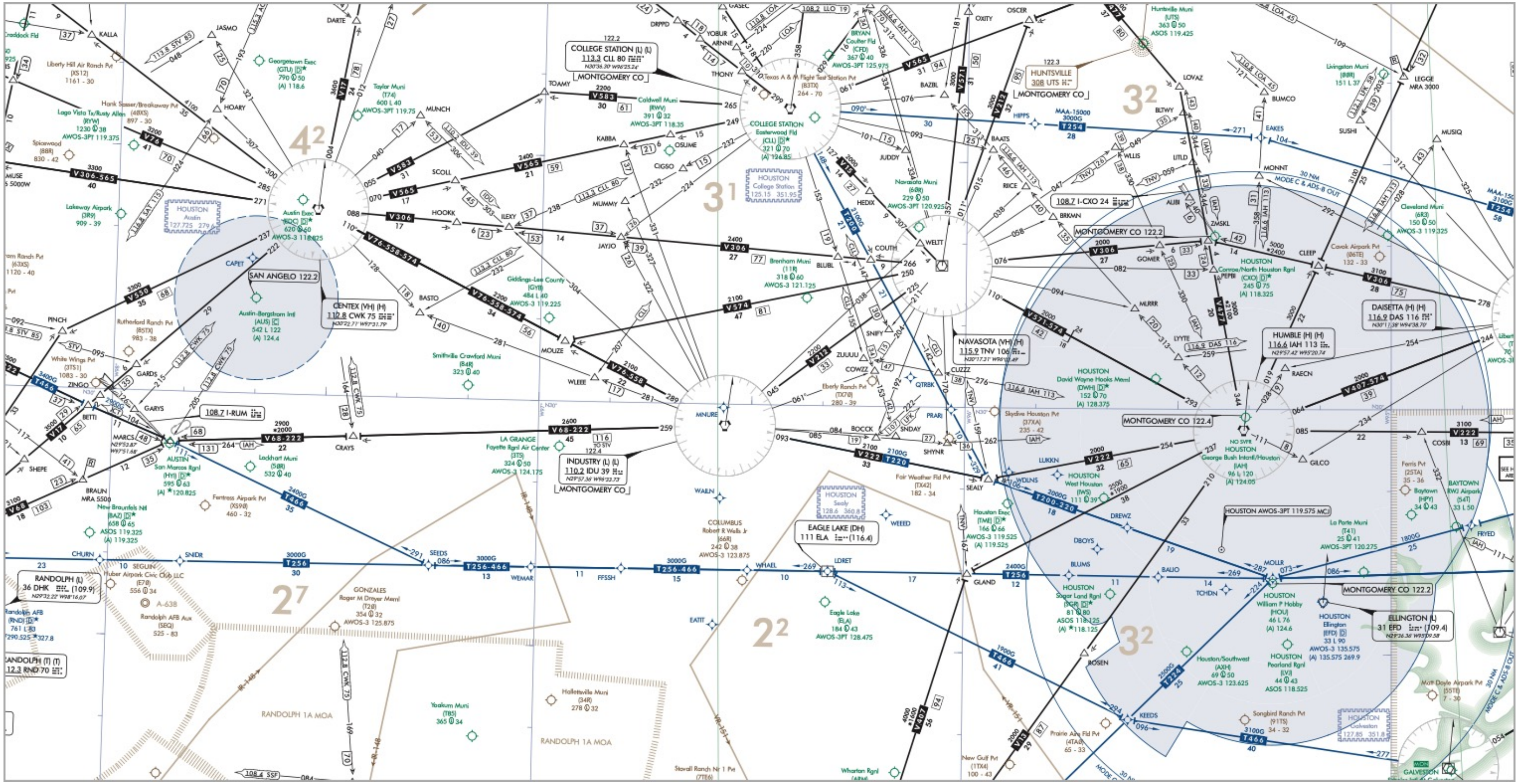
APPROACH MAP

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



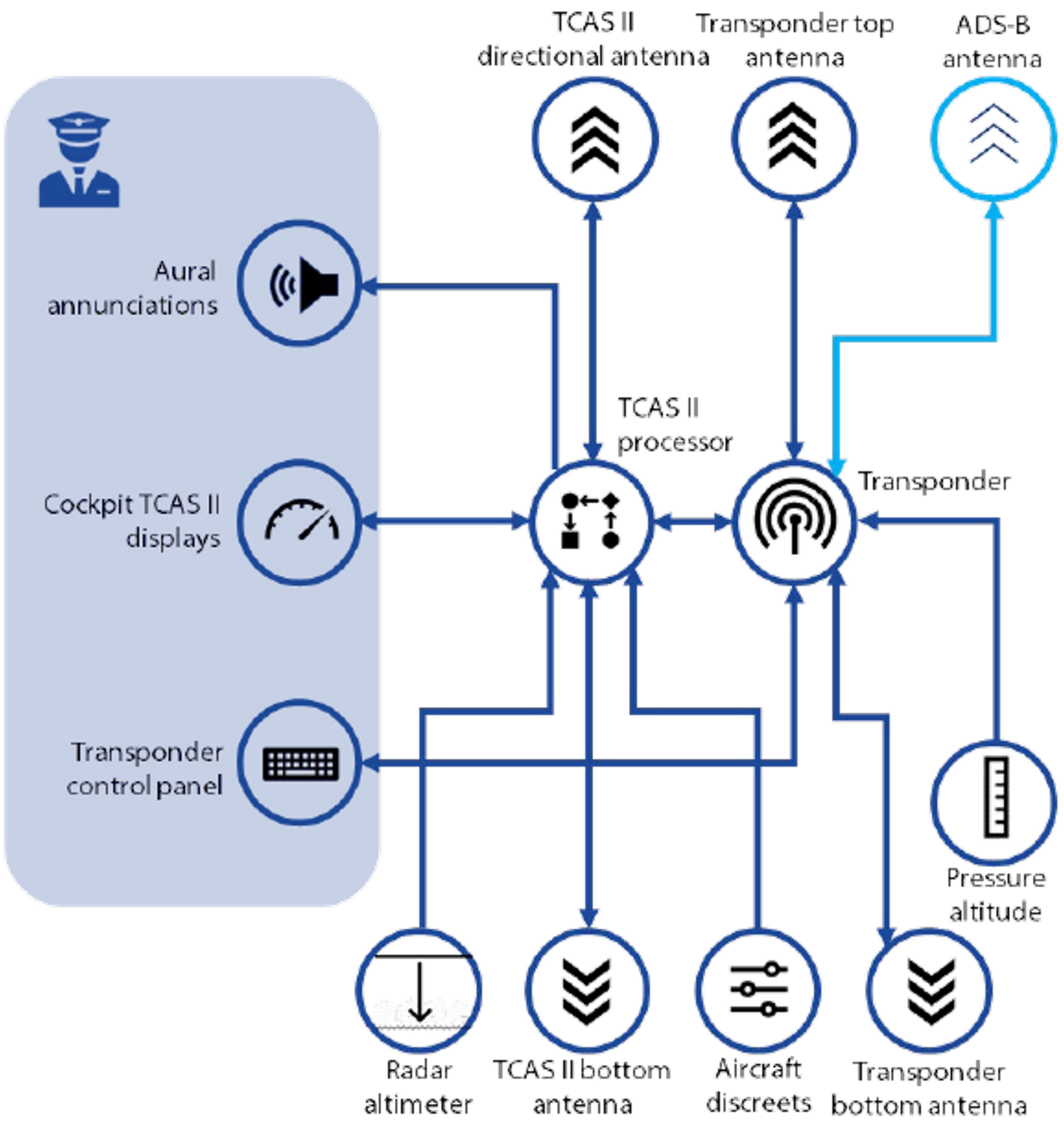
Reference:

AIRWAYS



TCAS SCHEMATICS

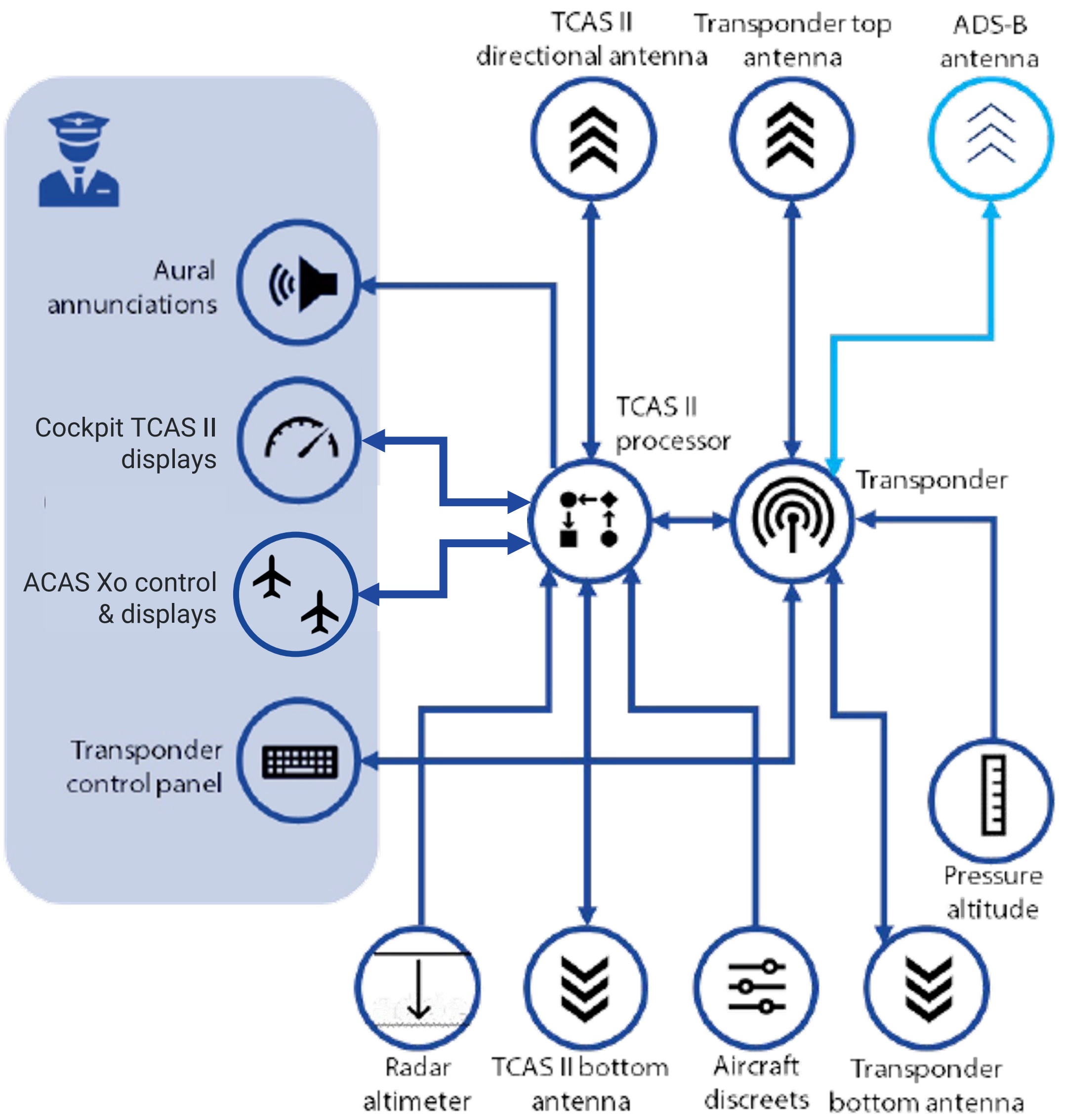
EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



By The original uploader, Sansc#/0**e at German Wikipedia.

ACAS SCHEMATICS

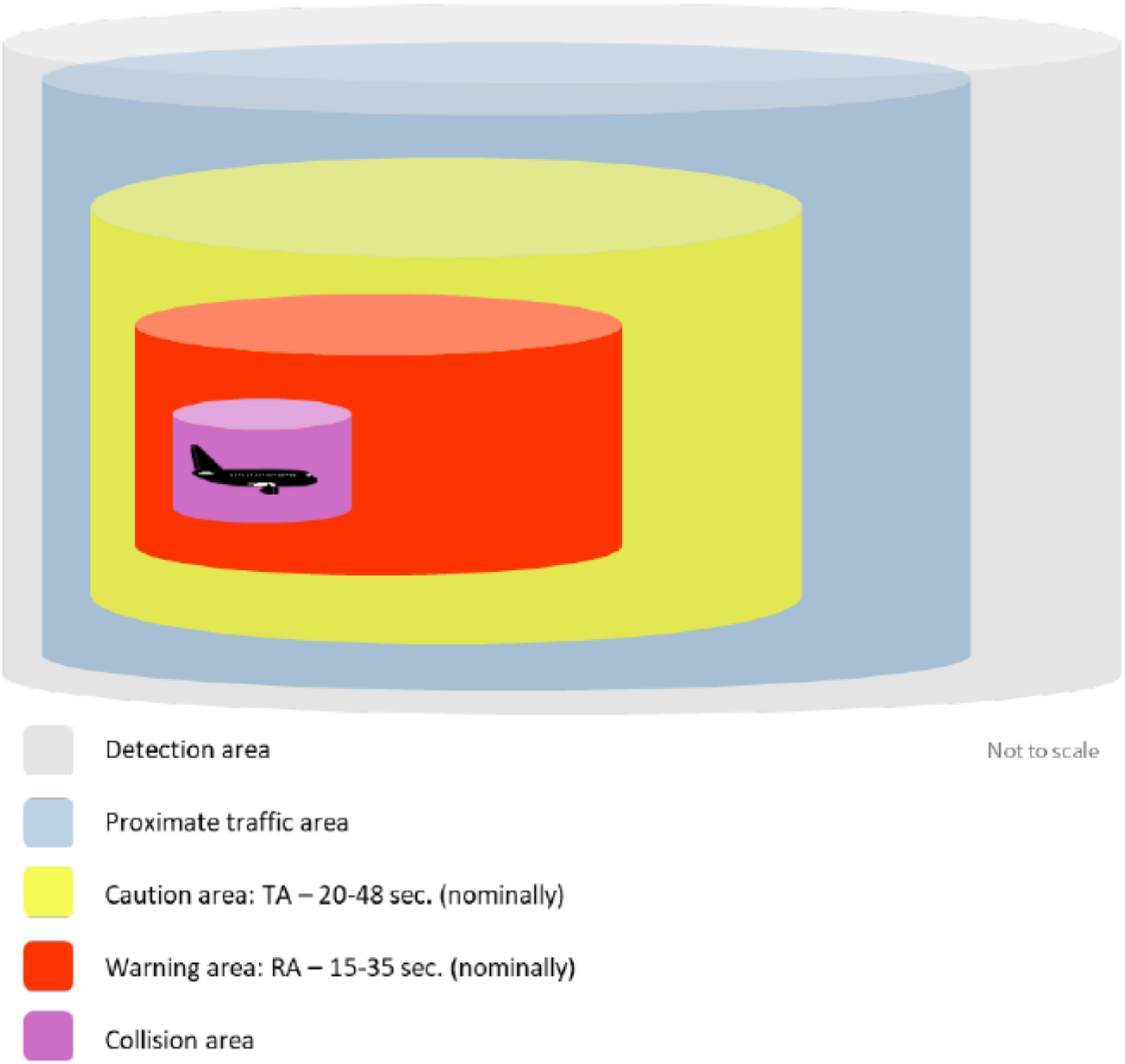
EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



By The original uploader, Sansc#/0**e at German Wikipedia.

TCAS II – ENVELOPE

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



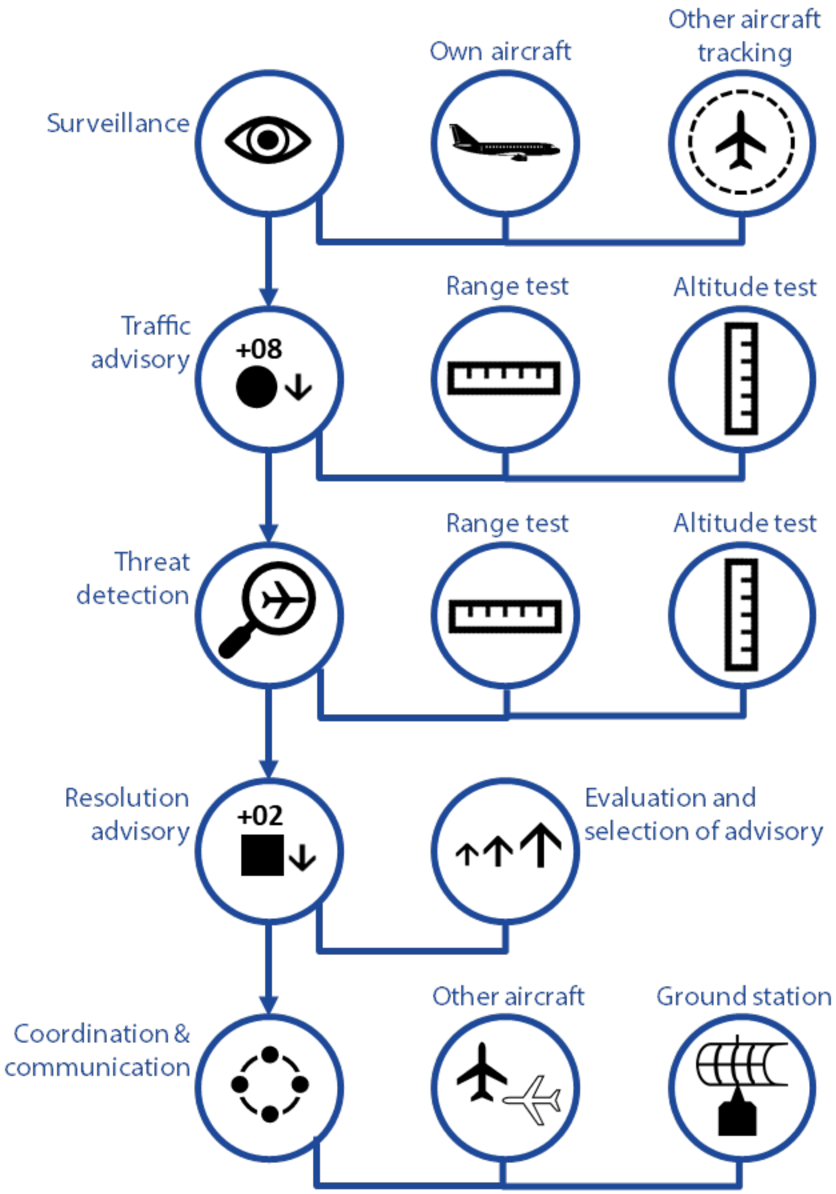
TCAS II – SENSIBILITY

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

Own Altitude	SL	tau values (sec)		TVTHR (sec)	DMOD values (NM)		ZTHR (feet) Alt. Threshold		ALIM (feet)
		TA	RA	RA	TA	RA	TA	RA	RA
0 – 1000 ft AGL	2	20	no RA	no RA	0.30	no RA	850	no RA	no RA
1000 – 2350 ft AGL	3	25	15	15	0.33	0.20	850	600	300
2350 ft AGL – FL50	4	30	20	18	0.48	0.35	850	600	300
FL50 – FL100	5	40	25	20	0.75	0.55	850	600	350
FL100 – FL200	6	45	30	22	1.00	0.80	850	600	400
FL200 – FL420	7	48	35	25	1.30	1.10	850	700	600
Above FL420	7	48	35	25	1.30	1.10	1200	800	700

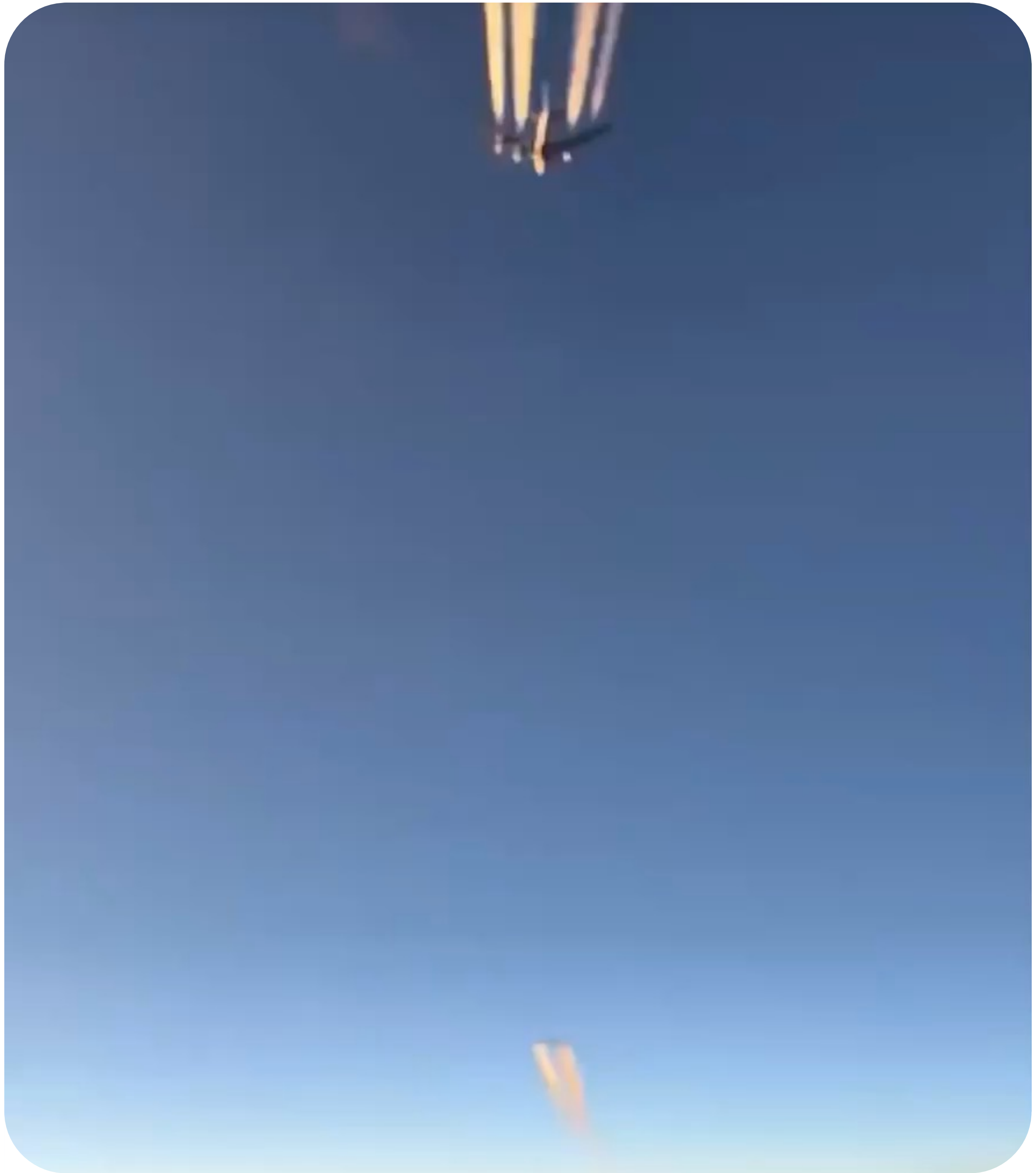
TCAS II LOGIC FUNCTIONS

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



EXAMPLE A/C – A/C

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)



B747 – A380 crossing above

1’000 ft separation (RSVM)

@FL340

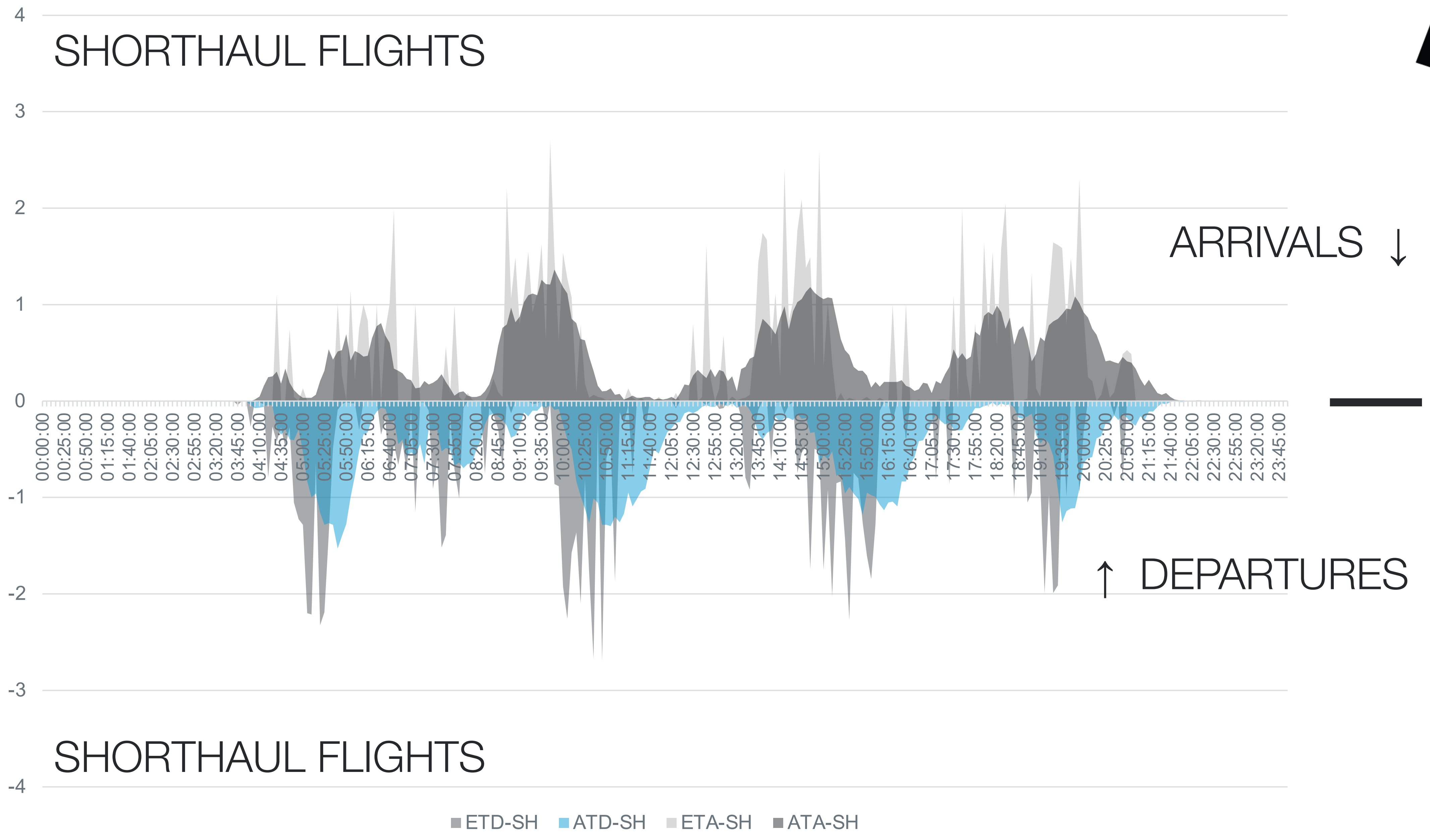
View from 2’000 ft below

EXAMPLE A/C – A/C

EXAMPLE FROM AVIATION (ACAS – TCAS, TRACKS, ROUTES, WAYPOINTS, ATC)

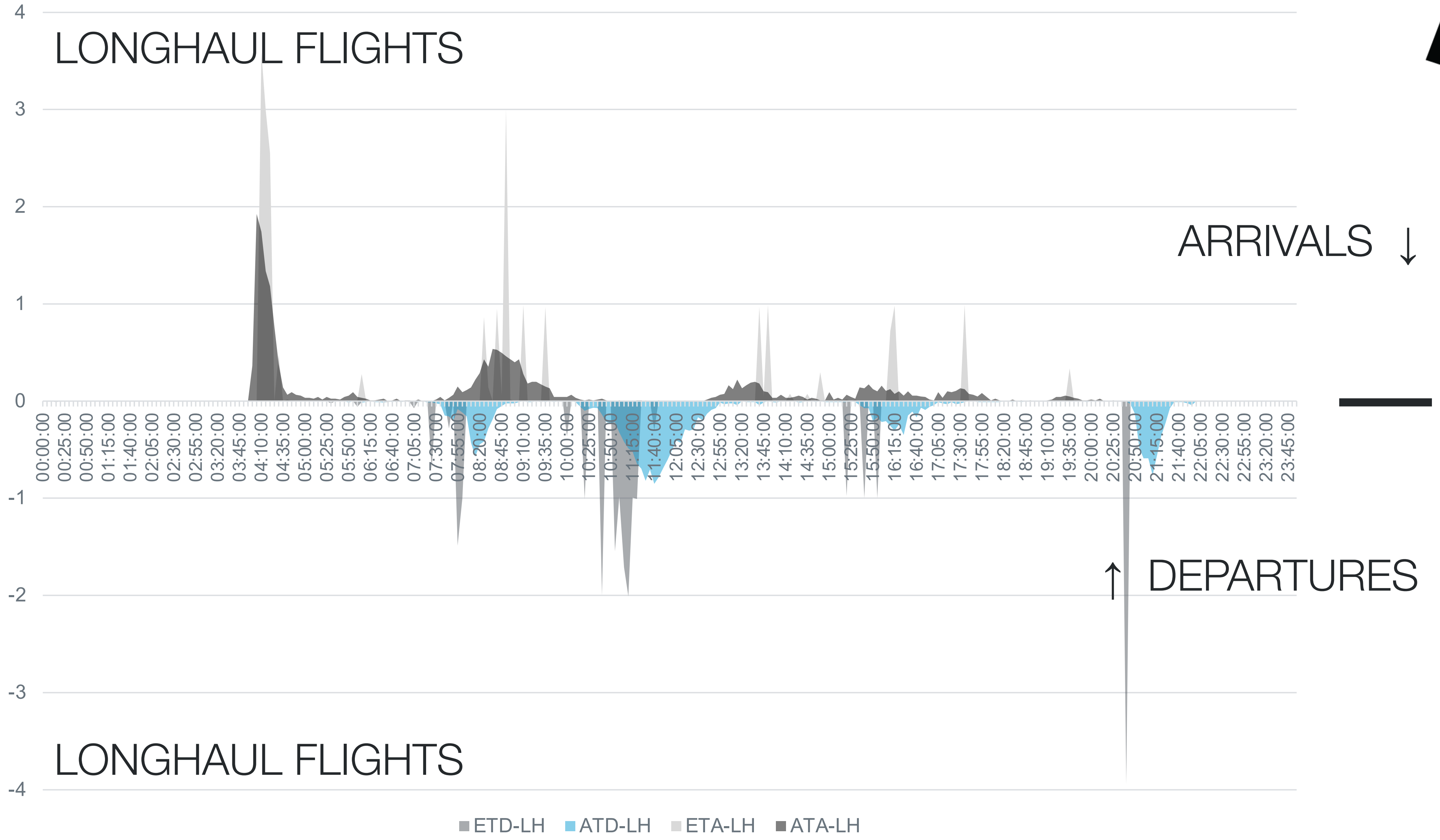
ZRH AIRPORT

DEPARTURE AND ARRIVALS (4 MONTHS DATA, 1 HB AIRLINES)



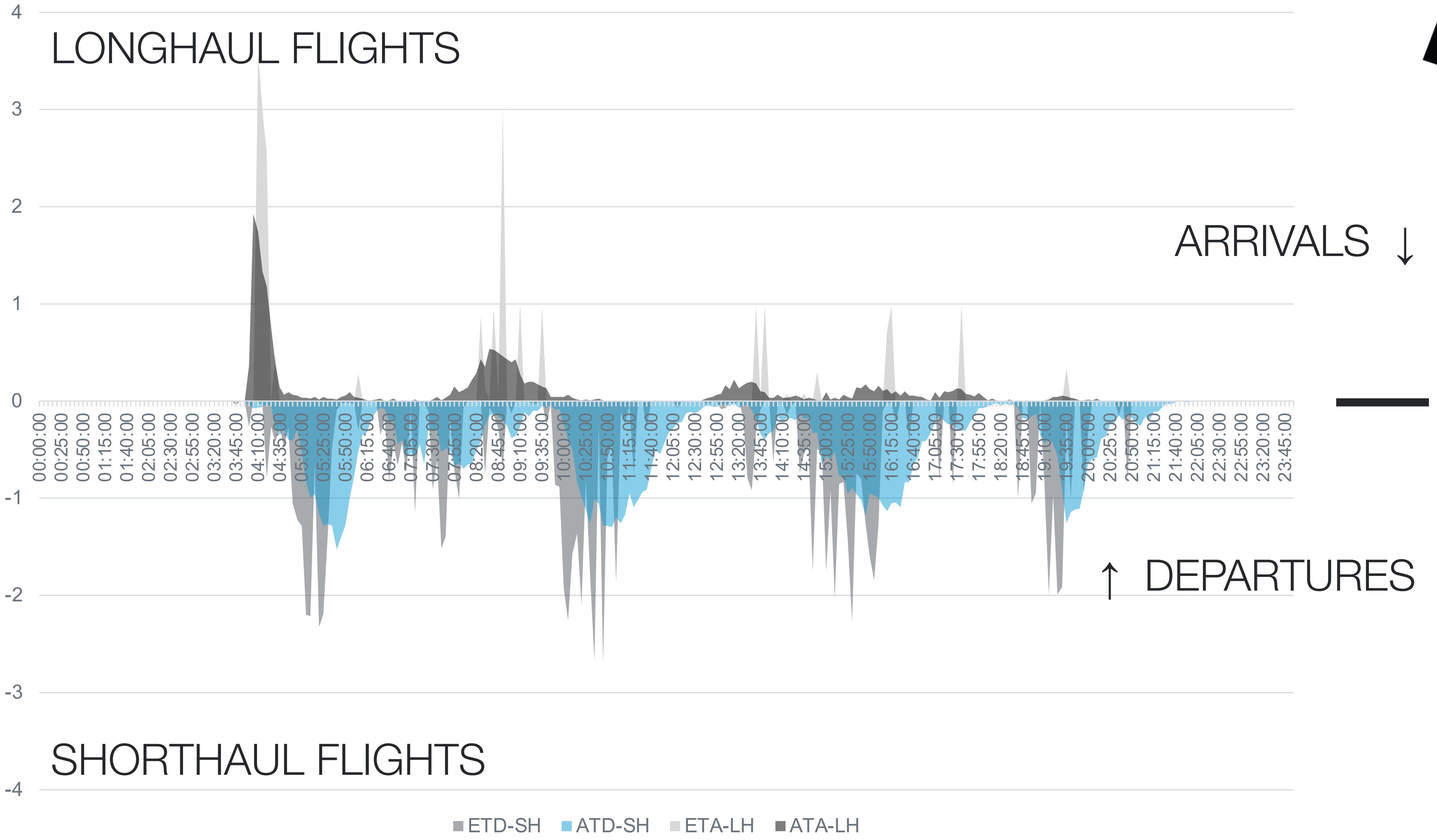
ZRH AIRPORT

DEPARTURE AND ARRIVALS (4 MONTHS DATA, 1 HB AIRLINES)



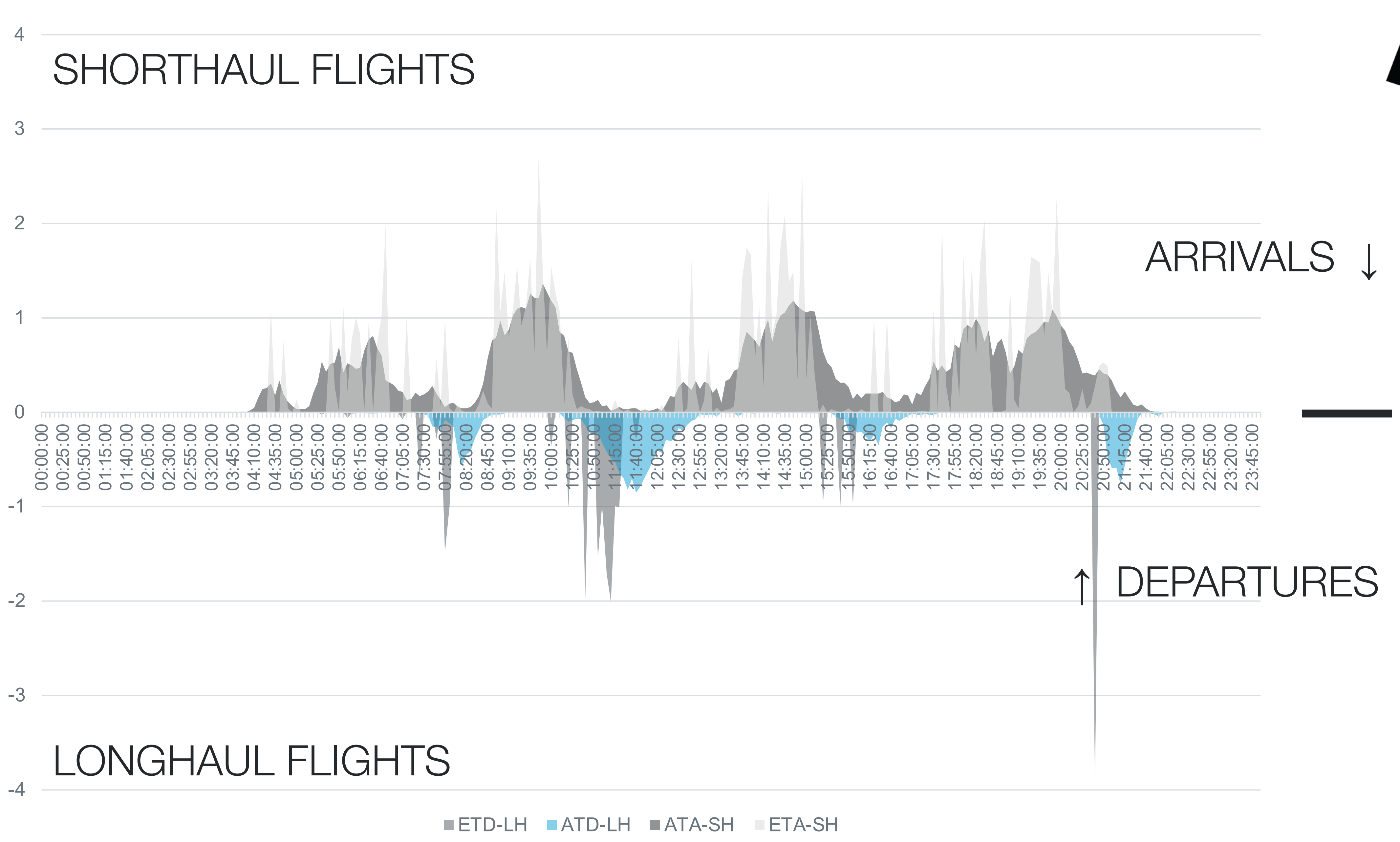
ZRH AIRPORT

DEPARTURE AND ARRIVALS (4 MONTHS DATA, 1 HB AIRLINES)



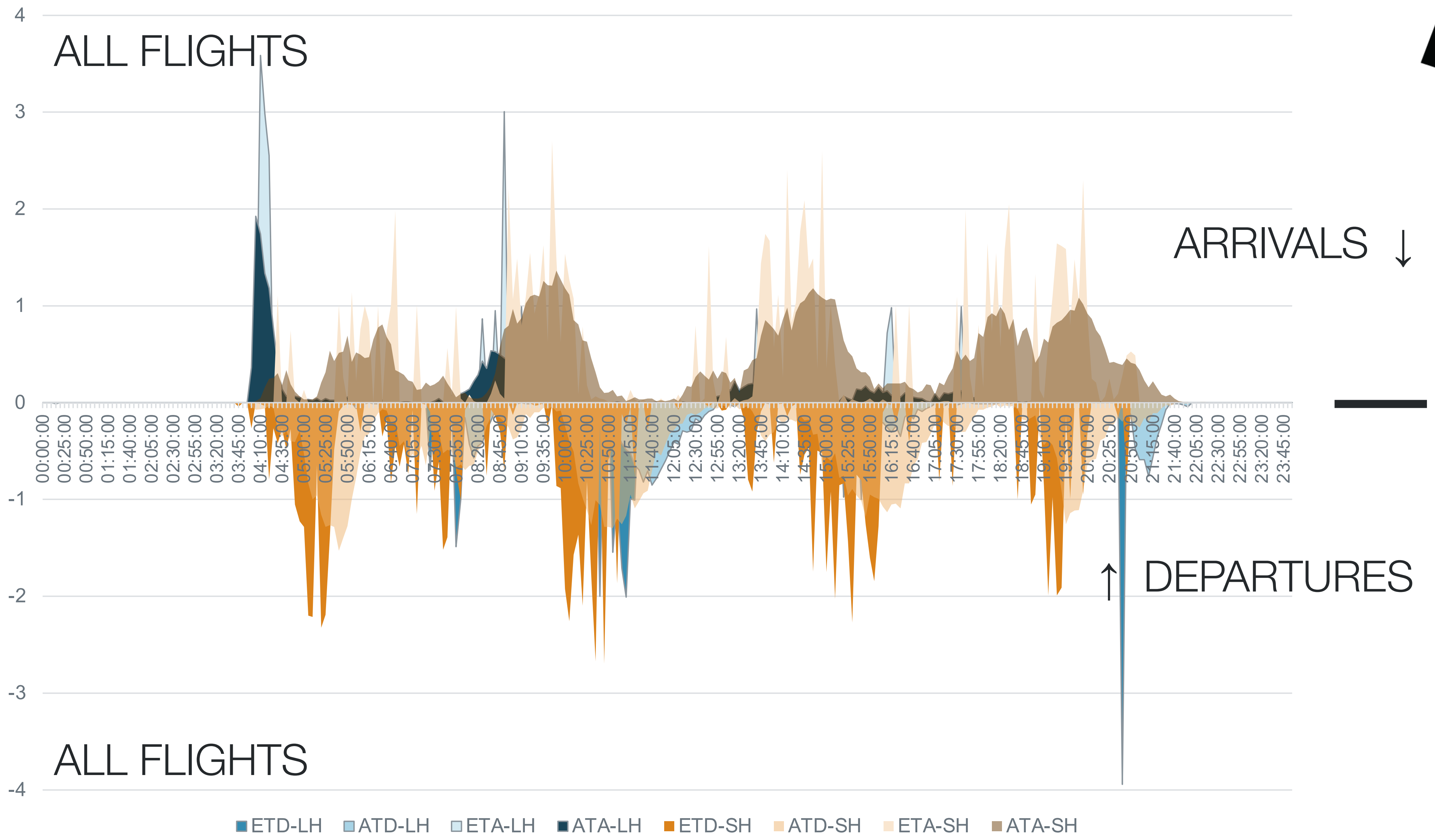
ZRH AIRPORT

DEPARTURE AND ARRIVALS (4 MONTHS DATA, 1 HB AIRLINES)



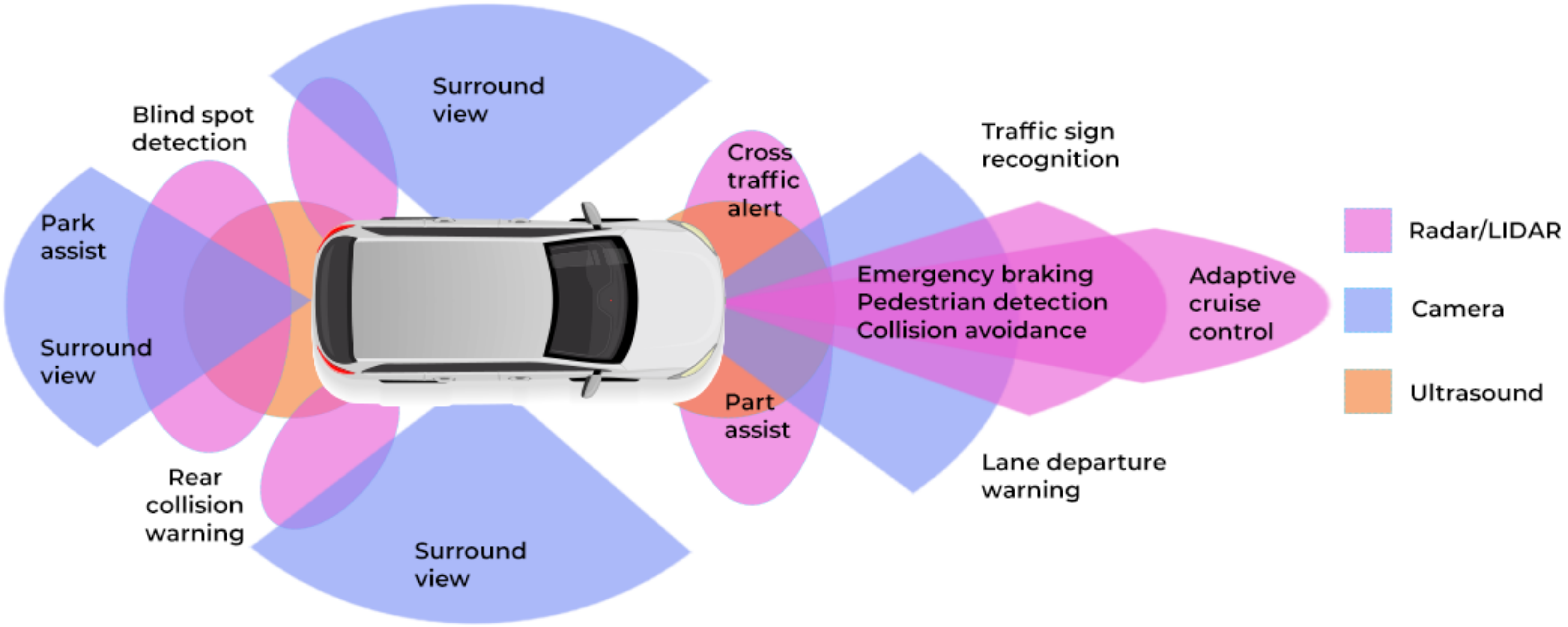
ZRH AIRPORT

DEPARTURE AND ARRIVALS (4 MONTHS DATA, 1 HB AIRLINES)



ADVANCED DRIVER-ASSISTANCE SYSTEMS

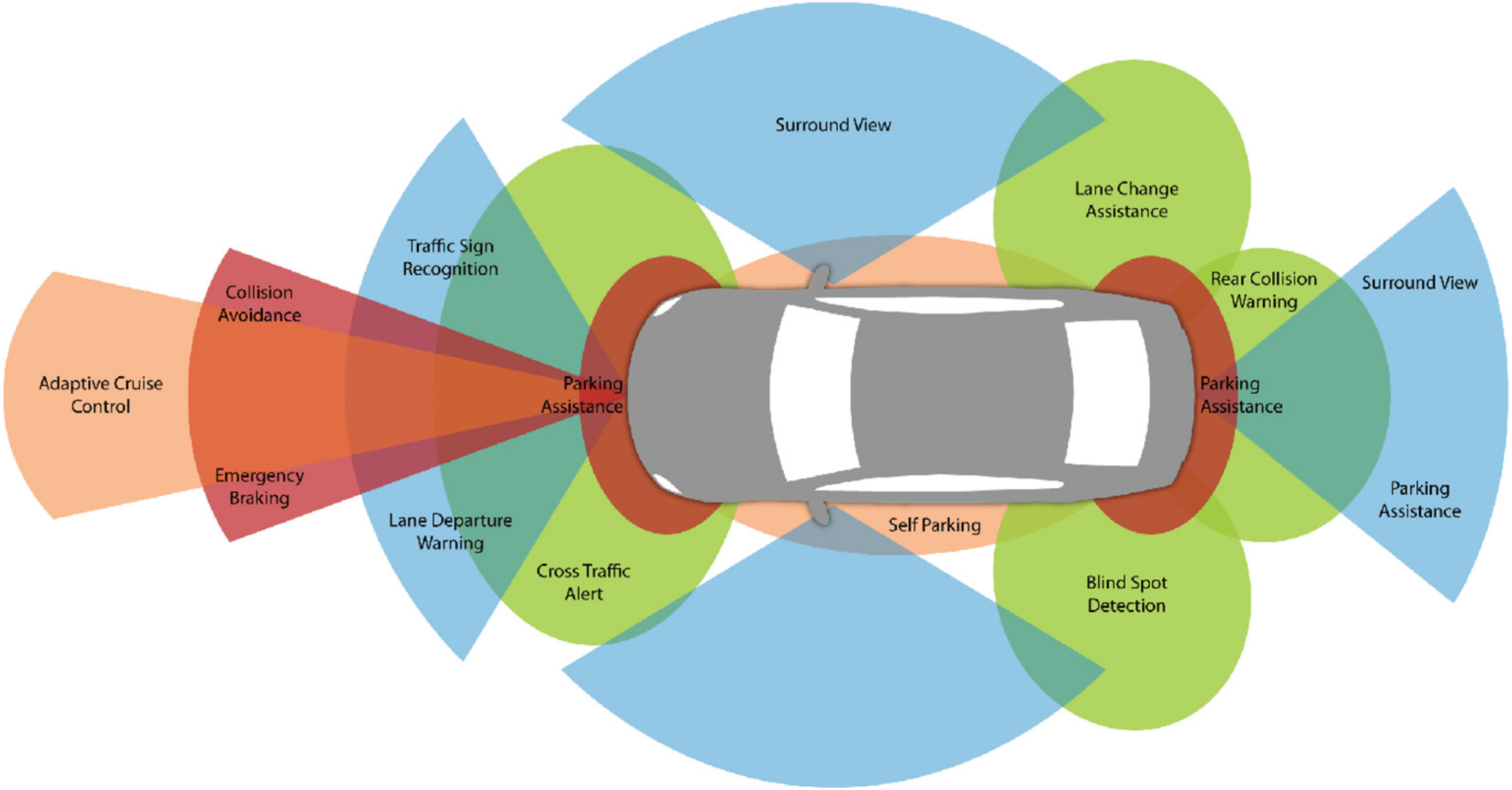
SYSTEMS AND ZONES OF SURVEILLANCE



https://doi.org/10.3390/s24196223

ADVANCED DRIVER-ASSISTANCE SYSTEMS

ZONES OF SURVEILLANCE



https://doi.org/10.3390/s24196223

COMPAIRASON

COMMERCIAL AVIATION, RAIL, AUTOMOTIVE

Description	Aviation	Railways	Road
Operating speed	~1’000 km/h	Approx. 300 km/h	Max. 120 km/h
Dimensions	3+1	1+1	2+1
Variables	Speed, VHL Directions	Speed, limited H-Direction	Speed, HL-Direction
Control centers	YES	YES	NO
Safety net	TCAS, ACAS	ETCS, Braking curve	ADAS (not mandatory)
Communication	V2V2I	V2I	None
Weight (gen, empty)	50 t – 267 t	100 t – 900 t	1 – 15 t
Lenght (gen)	50 – 80 m	100 – 400 m	5 – 25 m
Pax	100 – 500	500 – 1000	5 – 7 – 100

Own creation: Simone Bernasconi

V2V2I COMMUNICATION
DIGITAL HOOK – PLATOONING
SUPPRESSION OF GROUND BASED SIGNALING
AUTOMATED & INTEGRATED CONTROL SYSTEM
ADAPTIVE ROUTES / STOPS / TIMETABLES


AVALLE
MEETS
Davide Campari Lounge
August 14, 2025, 18:14
Co-sponsor
DARA CAPITAL
WEALTH AND INVESTMENT MANAGEMENT
In cooperation with
Locarno
Film Festival

LOOKING FORWARD DISCUSSING WITH YOU POSSIBLE COOPERATIONS

AVALLE

Simone Bernasconi

Chief Risk and Certification Officer / CEO Advisor at Manta Head of Advanced Transportation Programs at SUPSI

Founder & CEO, Avalle | Mobilities | meets

Sonnenbergstrasse 40B

CH-8610 Uster

simone@avalle.ch

+41795592929

Under the patronage of **HRH Prince Khalid Al-Faisal**
Advisor to the Custodian of the Two Holy Mosques & Governor ıof Makkah Region

CONFERENCE OMAINTEC 2025 EXHIBITION FM

المؤتمر الدولي الثاني والعشرون لإدارة الأصول والمرافق والصيانة

The 22nd International Asset, Facility & Maintenance Management Conference

Digitization - Excellence - Sustainability

THANK YOU!

26-28 January 2025
The Ritz-Carlton Jeddah, Kingdom of Saudi Arabia

www.omaintec.com #OmaintecConf

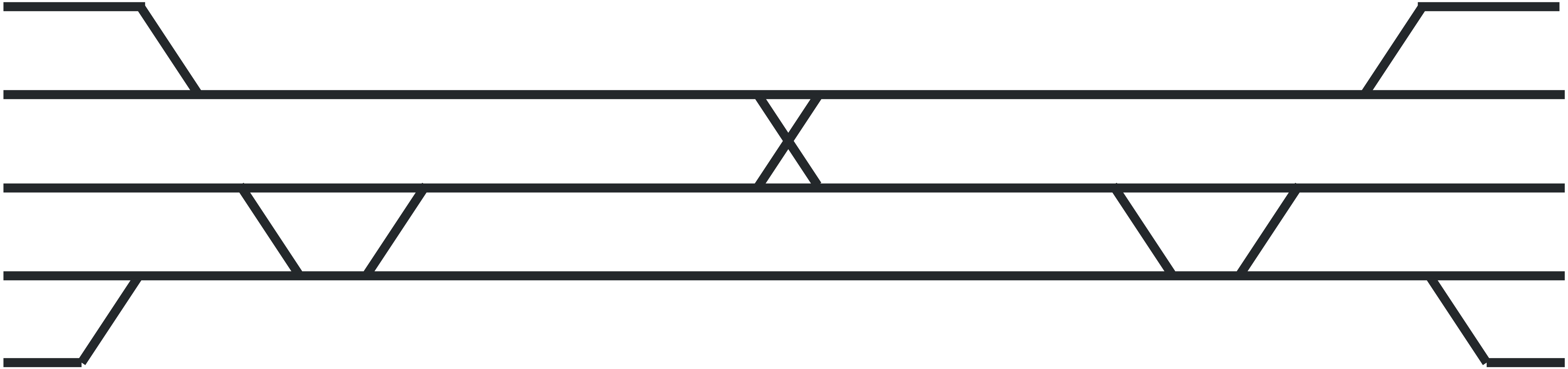
An Intiative By

OMAINTEC
المجلس العربي لإدارة الأصول والمرافق والصيانة
Arab Asset, Facility and Maintenance Management Council

Organized by

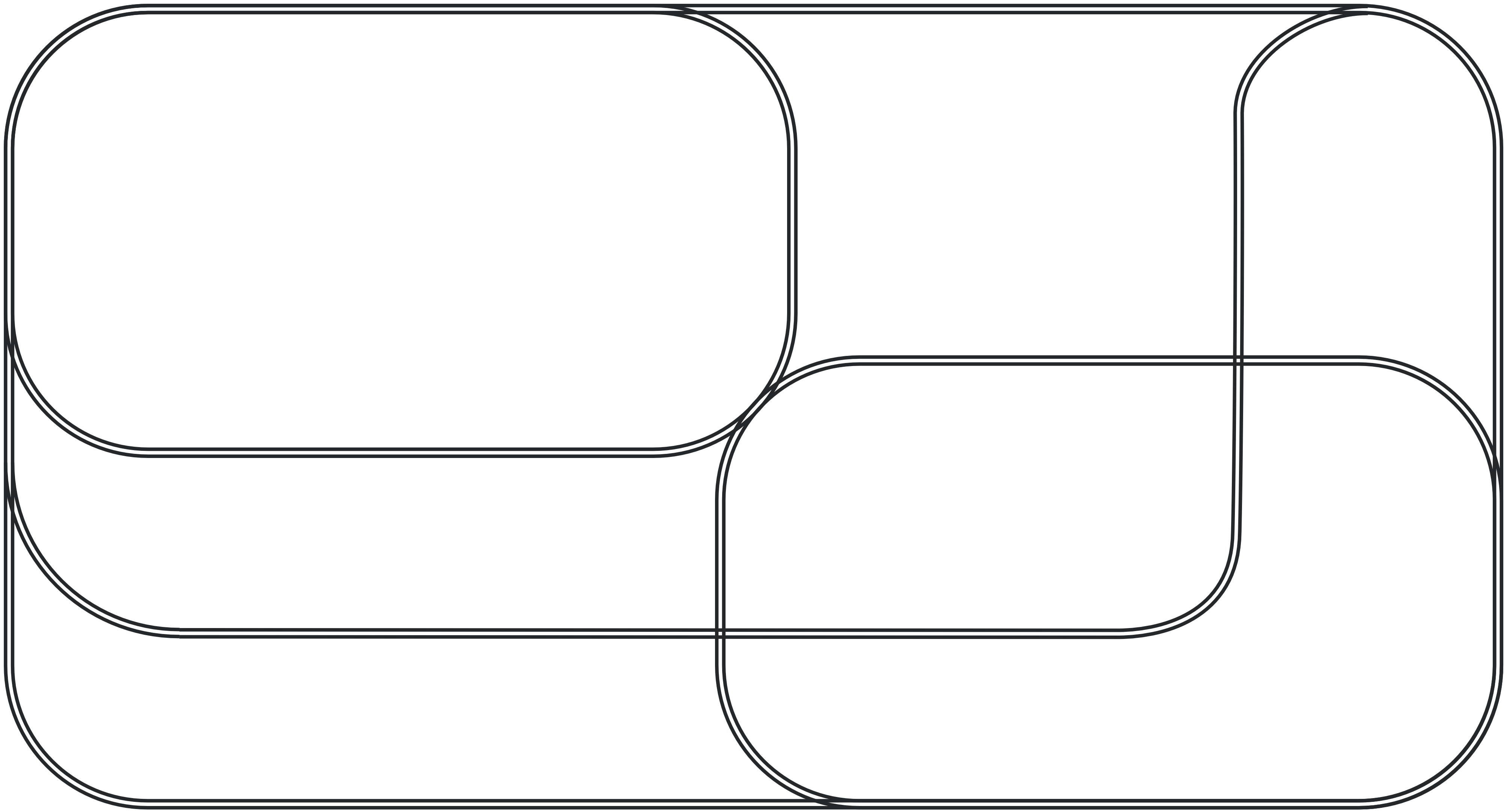
TSG | EXICON.
The Specialist Group • شركة مجموعة المختص

EXERCISE 1



EXERCISE 2

EXERCISE 3



EXERCISE 4 – FREE TOPIC & ACTIVITY

Under the patronage of **HRH Prince Khalid Al-Faisal**
Advisor to the Custodian of the Two Holy Mosques & Governor of Makkah Region

CONFERENCE OMAINTEC 2025 EXHIBITION FM

المؤتمر الدولي الثاني والعشرون لإدارة الأصول والمرافق والصيانة

The 22nd International Asset, Facility & Maintenance Management Conference

Digitization - Excellence - Sustainability

How digitalization could change control systems in metro and railways systems

TECHNOLOGY CARDS

26-28 January 2025
The Ritz-Carlton Jeddah, Kingdom of Saudi Arabia

www.omaintec.com #OmaintecConf

An Intiative By
OMAINTEC
المجلس العربي لإدارة الأصول والمرافق والصيانة
Arab Asset, Facility and Maintenance Management Council

Organized by
TSG | EXICON.
The Specialist Group • شركة مجموعة المختص

SOURCES

DIGITAL PERISCOPE 2018

The Top 30 Emerging Technologies (2018–2028)

https://medium.com/@seanmoffitt/the-top-30-emerging-technologies-2018-2028-eca0dfb0f43c

SSBM Geneva

(Swiss School of Business and Management Geneva)

Top 25 Emerging Technology Trends to Watch in 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

TECHVISION 50

2024 - Fifty Emerging Technologies and Materials That Will Shape the Future

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

Fynd Academy

Best 30 Emerging Technologies & Trends in 2025 and Beyond

https://www.fynd.academy/blog/latest-technologies

WEF Strategic Intelligence

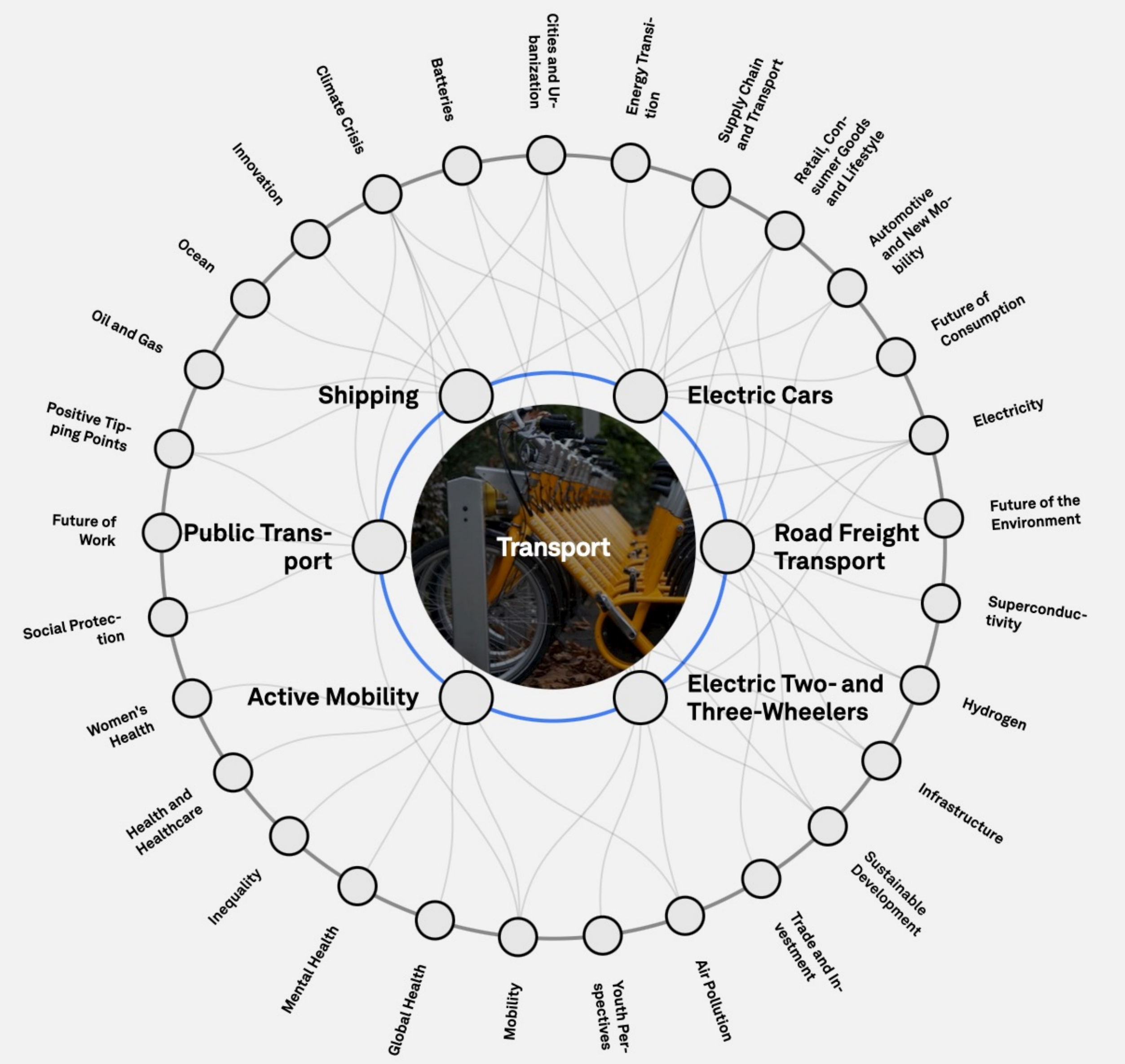
https://intelligence.weforum.org/topics

Extract of Interest

EXTRACT OF INTEREST

https://medium.com/@seanmoffitt/the-top-30-emerging-technologies-2018-2028-eca0dfb0f43c

TRANSPORT
WEF STRATEGIC INTELLIGENCE



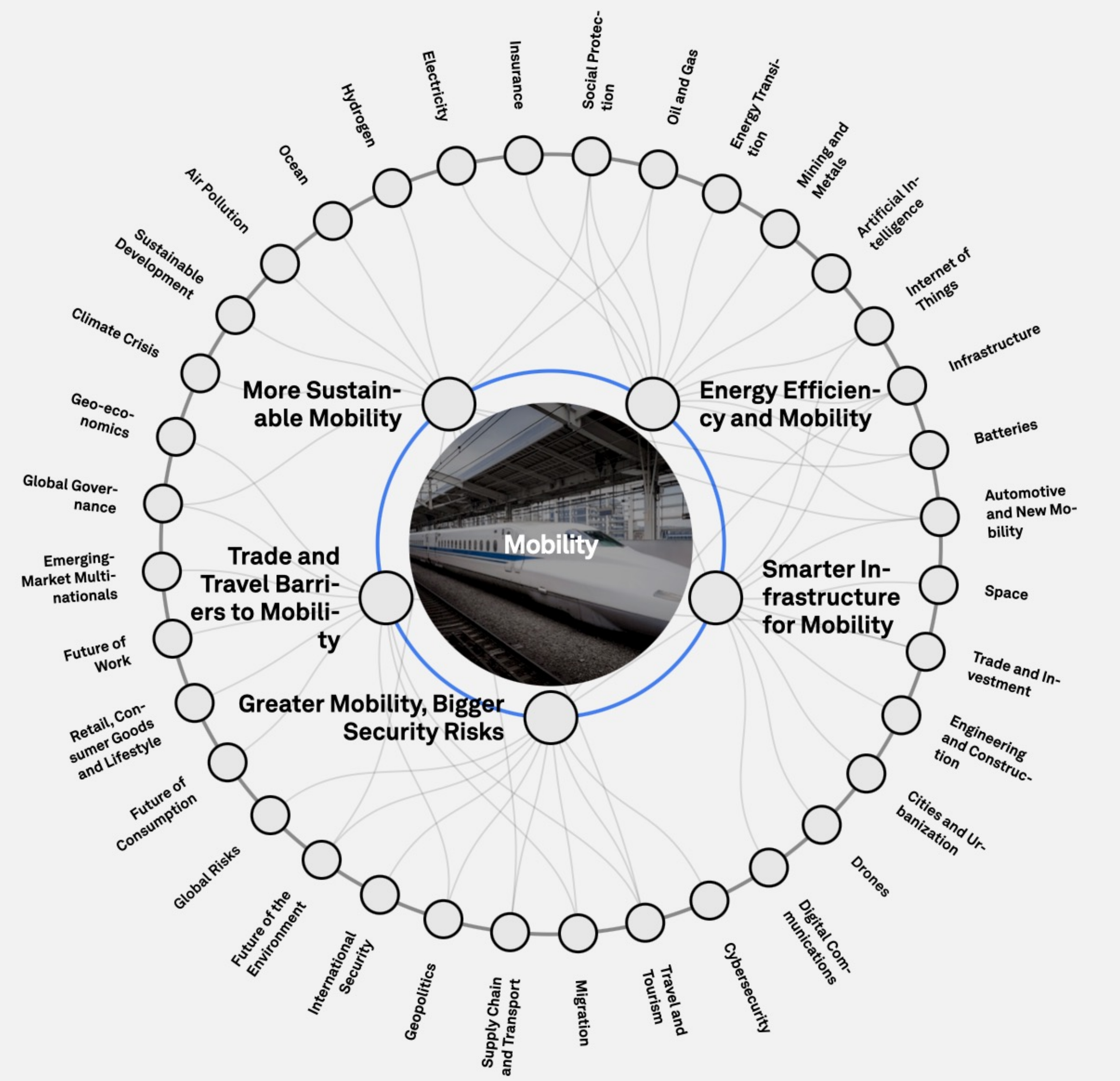
Curation

The transport sector will be difficult to decarbonize. It still relies heavily on fossil fuels, and majority of the emissions it generates come from road transport (73%), followed by aviation (12%), shipping (11%), and rail (2.5%). However, the emergence of hybrid- and battery-electric vehicles has created positive tipping points of acceleration in several markets, where they are already often cheaper to own than internal-combustion-engine models. China leads in all aspects of the electrification of transport; half of all new cars there are now battery-electric, it has the steepest acceleration curve in deployment, and the largest export market. Heavy-duty vehicles, aviation, and shipping are particularly challenging to decarbonize, though large manufacturers are investing in the electrification of buses and trucks, coastal shipping, and short-haul aviation (while experimenting with green ammonia for shipping, and renewable fuel blends for long-haul aviation). Merely switching to battery-electric will not make global mobility systems environmentally sustainable - reducing demand for private-car ownership and shifting to two- and three-wheeled options and public transport, especially in cities, will be key.

This briefing is based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with Professor Tim Lenton and Dr. Steve Smith at the Global Systems Institute, University of Exeter. The content does not necessarily reflect the views of the Forum.

MOBILITY

WEF STRATEGIC INTELLIGENCE

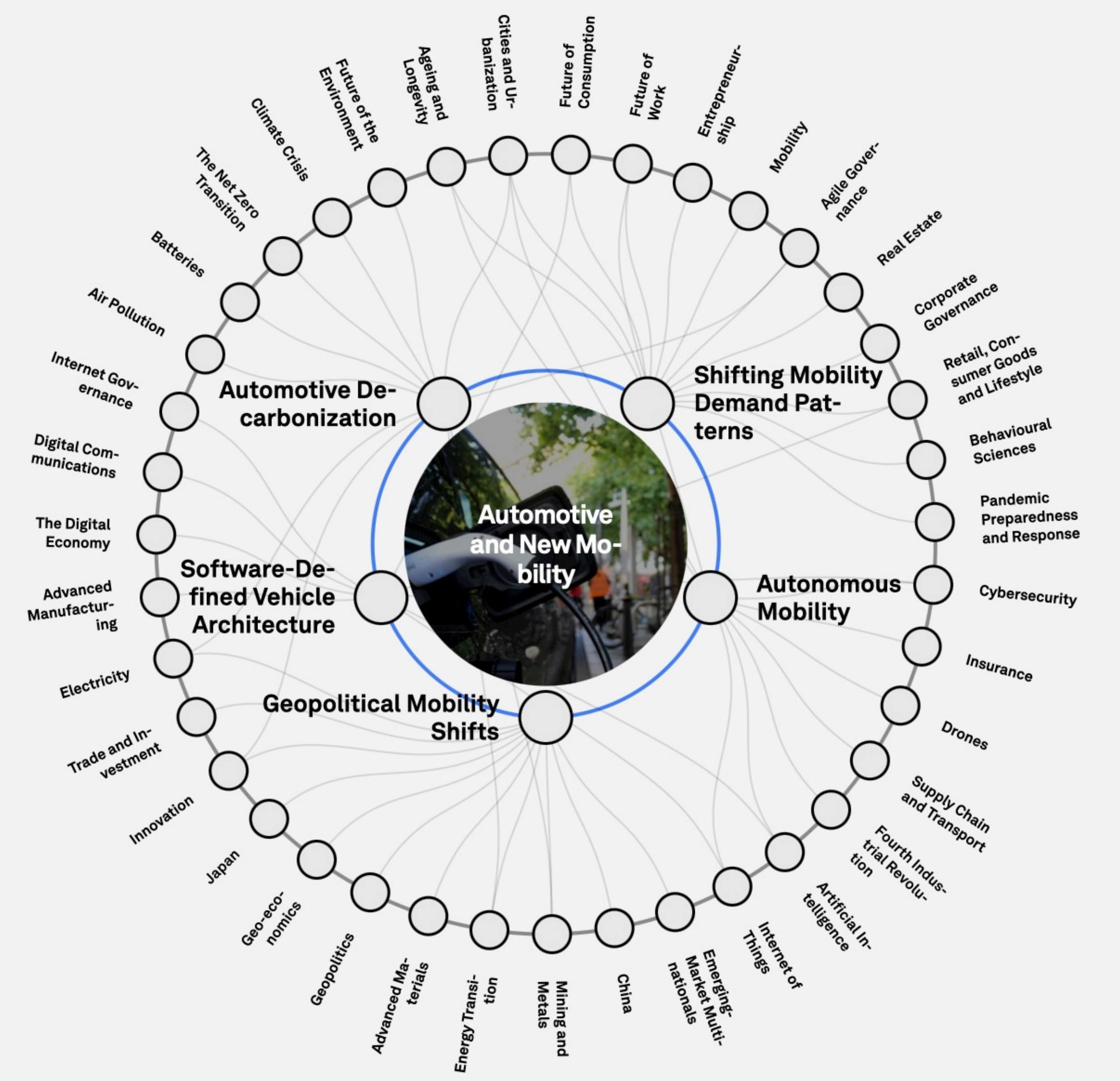


Curation
Created by World Economic Forum, licensed for personal/academic use only, not for reproduction.

Mobility is a fundamental human need, and an essential enabler of prosperity. But the current mobility paradigm is not sustainable; car travel causes millions of deaths every year, a significant amount of greenhouse gas emissions are transport-related, and congestion causes heavy financial losses. There is hope on the horizon, however - the global mobility system is in the early stages of massive transformation, as new technologies enable innovative related businesses, and as policy-makers seek out ways to foster mobility that is smarter, cleaner, and more inclusive.

AUTOM. & NEW MOBILITY

WEF STRATEGIC INTELLIGENCE



Curation

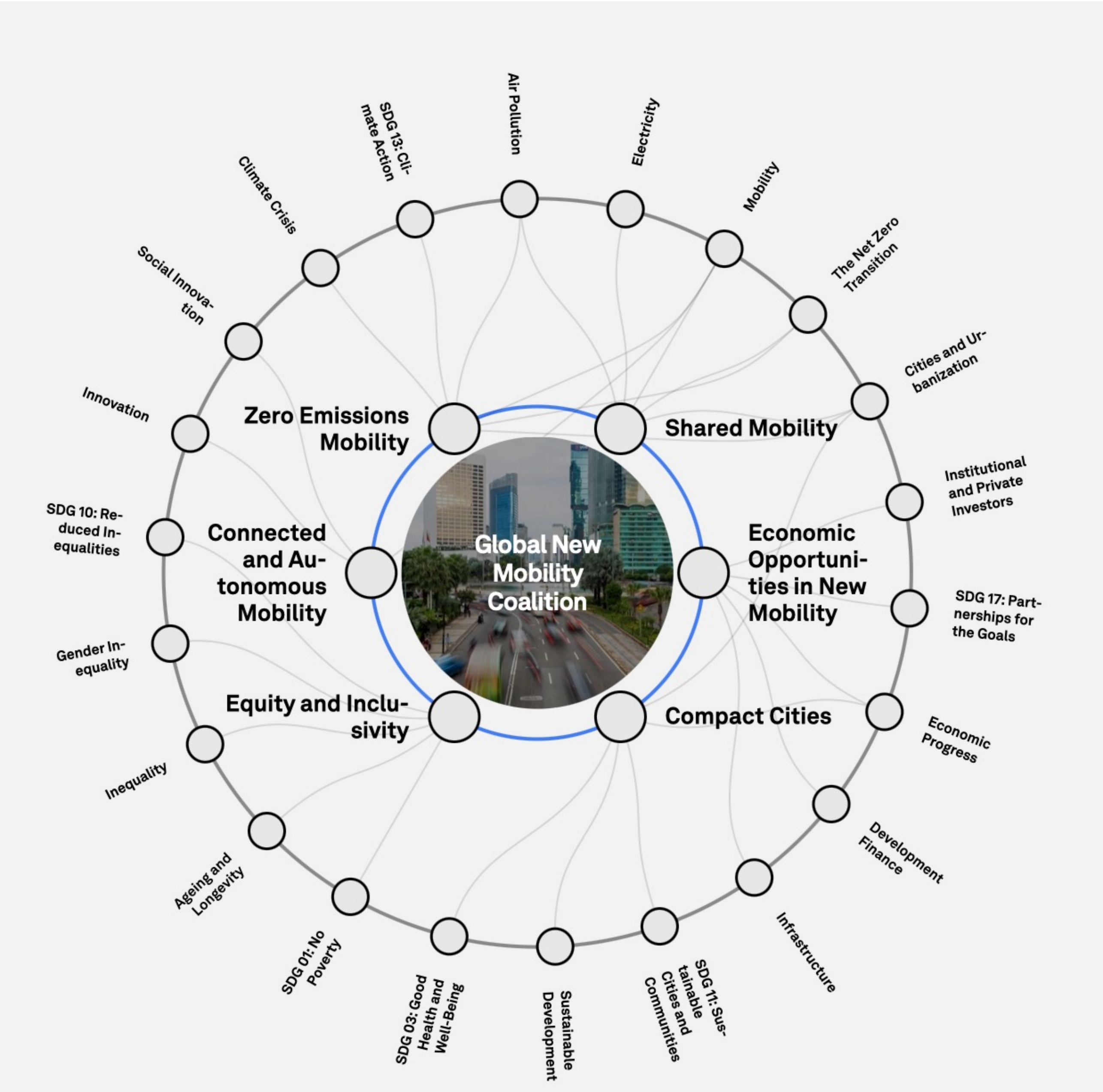
Created by Massachusetts Institute of Technology (MIT), licensed for personal/academic use only, not for reproduction.

The global automotive industry is in a state of profound change, and faces an array of challenges. Road transport accounts for about 15% of global CO2 emissions, and while many argue the best way to decarbonize it is through electrification or hydrogen fuel cells, others say the car itself is the problem. Particularly in dense, urban environments, effectively decarbonizing transportation may require a significant shift to public transportation and micromobility (things like bikesharing and e-scooters). The World Health Organization estimates that 1.2 million people are killed on the world's roads each year; automated technology has the potential to drastically reduce that figure, if deployed properly. Other means to improve safety include better road design and driver education. Meanwhile carsharing, ride-hailing, and microtransit can also help reduce car dependency more generally.

This briefing based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with John Moavenzadeh and Jinhua Zhao from the MIT Mobility Initiative. The content does not necessarily reflect the views of the Forum.

NEW MOBILITY COALITION

WEF STRATEGIC INTELLIGENCE

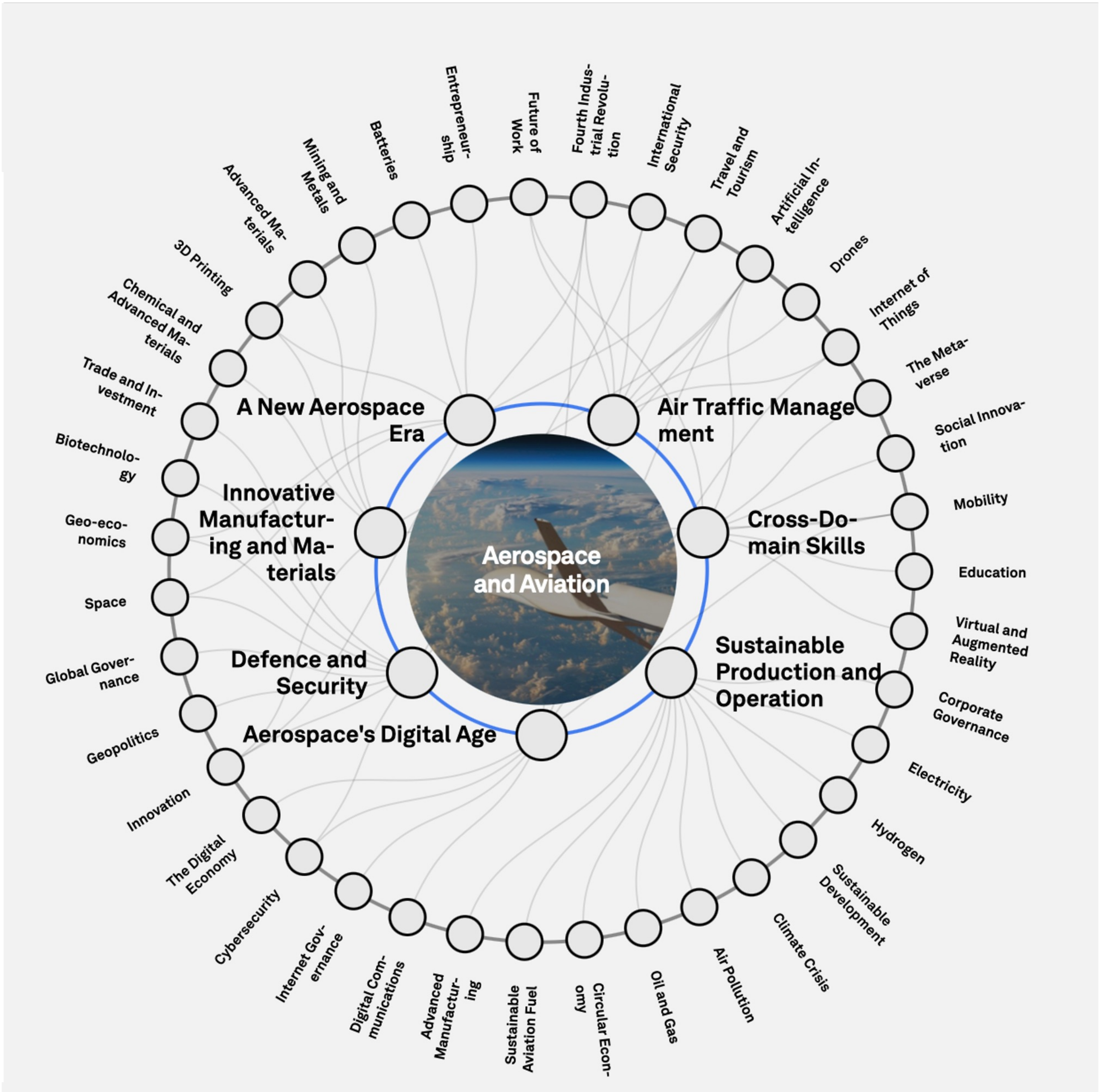


Curation
Created by World Economic Forum, licensed for personal/academic use only, not for reproduction.

The Global New Mobility Coalition (GNMC) brings together the public and private sectors to tackle the footprint of mobility in cities – both physical and environmental. Through strong public private collaboration, the GNMC aims to help cities and companies to achieve more resilient, healthy and decarbonized mobility systems, while highlighting the potential of new technologies and business models to cut congestion, reduce emissions, and improve quality of life for residents. The GNMC promotes industry and policy collaboration to guide effective, impactful, and practical actions that can further this vision for modern, sustainable urban environments. The methods employed by the GNMC encompass multi-stakeholder engagement, cross-sector awareness, and consensus-driven action.

AVIATION / AEROSPACE

WEF STRATEGIC INTELLIGENCE



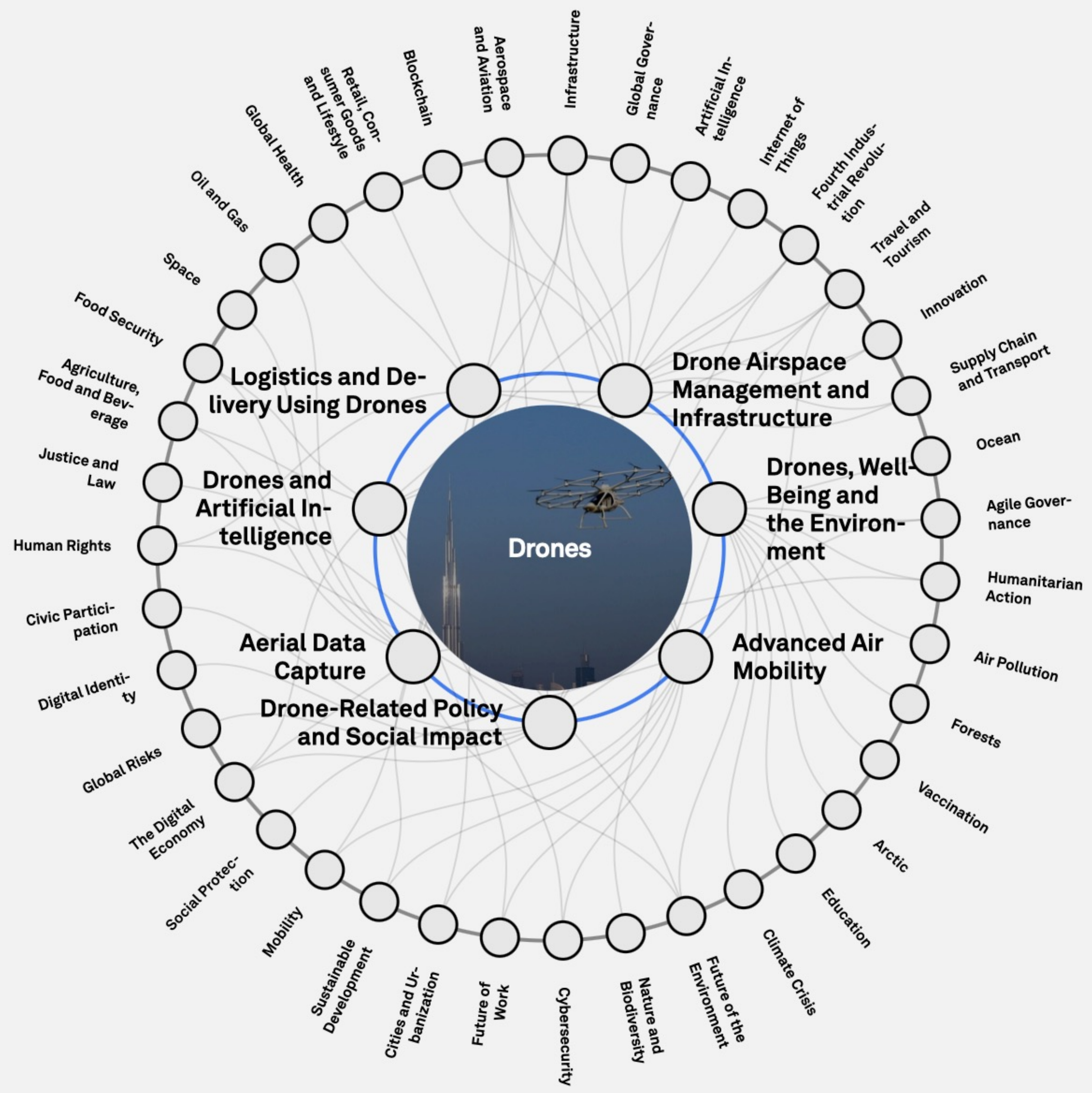
Curation
Created by Nanyang Technological University (NTU), licensed for personal/academic use only, not for reproduction.

Thanks to relentless innovation and greater access to digital information, the air-traffic management of manned and unmanned flights is expected to become far better integrated - as a new era for drones comes to the fore. More sustainable production and operation of air- and spacecraft is also anticipated, and space access is becoming more affordable thanks to reusable rockets and miniaturized technology. Meanwhile the aerospace industry’s role in defence and security remains critical, particularly amid the increasing militarization of space.

This briefing is based on the views of a wide range of experts from the World Economic Forum’s Expert Network and is curated in partnership with Professor Soo Jay Phee, Acting Dean of the College of Engineering, and Daniel New Tze How, Associate Professor, Nanyang Technological University. The content does not necessarily reflect the views of the Forum.

DRONES

WEF STRATEGIC INTELLIGENCE



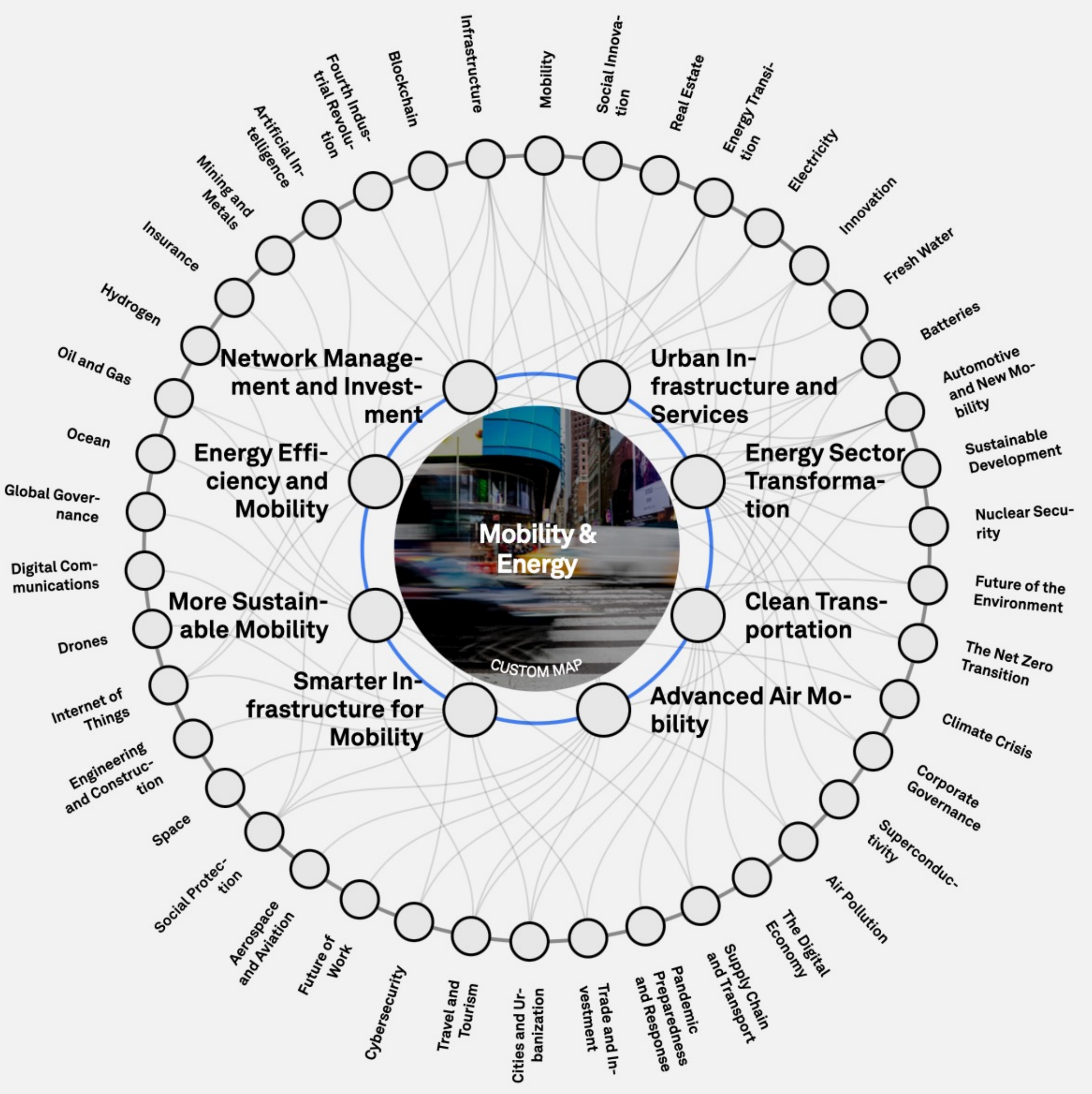
Curation

Created by Embry-Riddle Aeronautical University, licensed for personal/academic use only, not for reproduction.

Drones are being deployed to improve crop yields, to help maintain critical infrastructure, and to efficiently deliver COVID-19 vaccines in some parts of the world. They may soon be relied on just about everywhere for routine package delivery, and while larger drones remain mostly restricted to the military they are poised for expansion into civilian markets once airspace integration issues can be resolved. Advances in artificial intelligence should open new doors for drone applications in the future, though challenges remain in terms of synthesis with manned aircraft, appropriate infrastructure, regulatory frameworks, and public acceptance.

This briefing is based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with Dr. Kristy Kiernan, Assistant Professor, Dr. Stefan Kleinke, Associate Professor, and Christian Janke, Assistant Professor, at Embry-Riddle Aeronautical University. The content does not necessarily reflect the views of the Forum.

MOBILITY & ENERGY
WEF STRATEGIC INTELLIGENCE

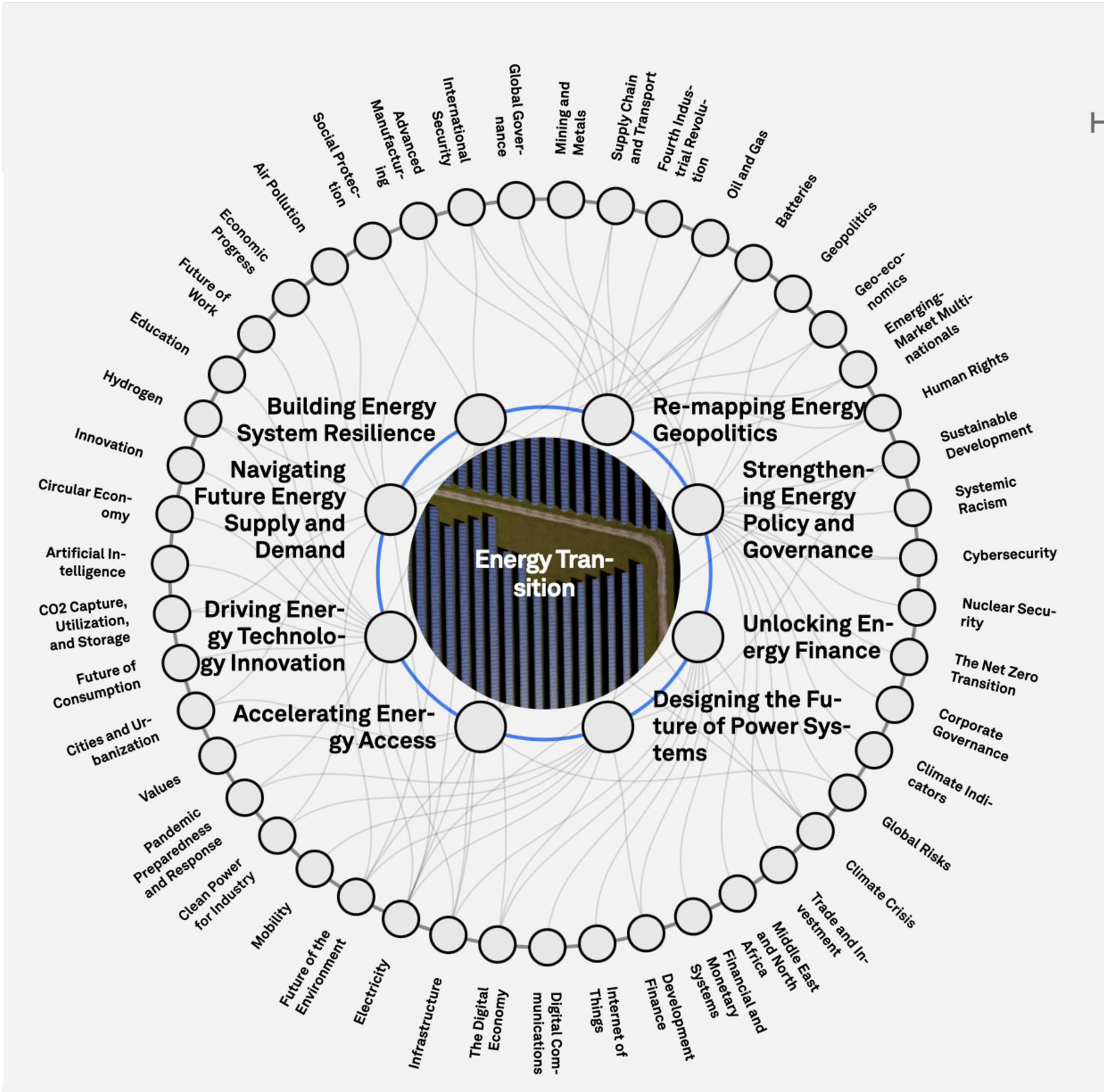


Curation
Created by Simone Bernasconi, licensed for personal/academic use only, not for reproduction.

See Mobility & Energies (next 3 pages).

ENERGY TRANSITION

WEF STRATEGIC INTELLIGENCE



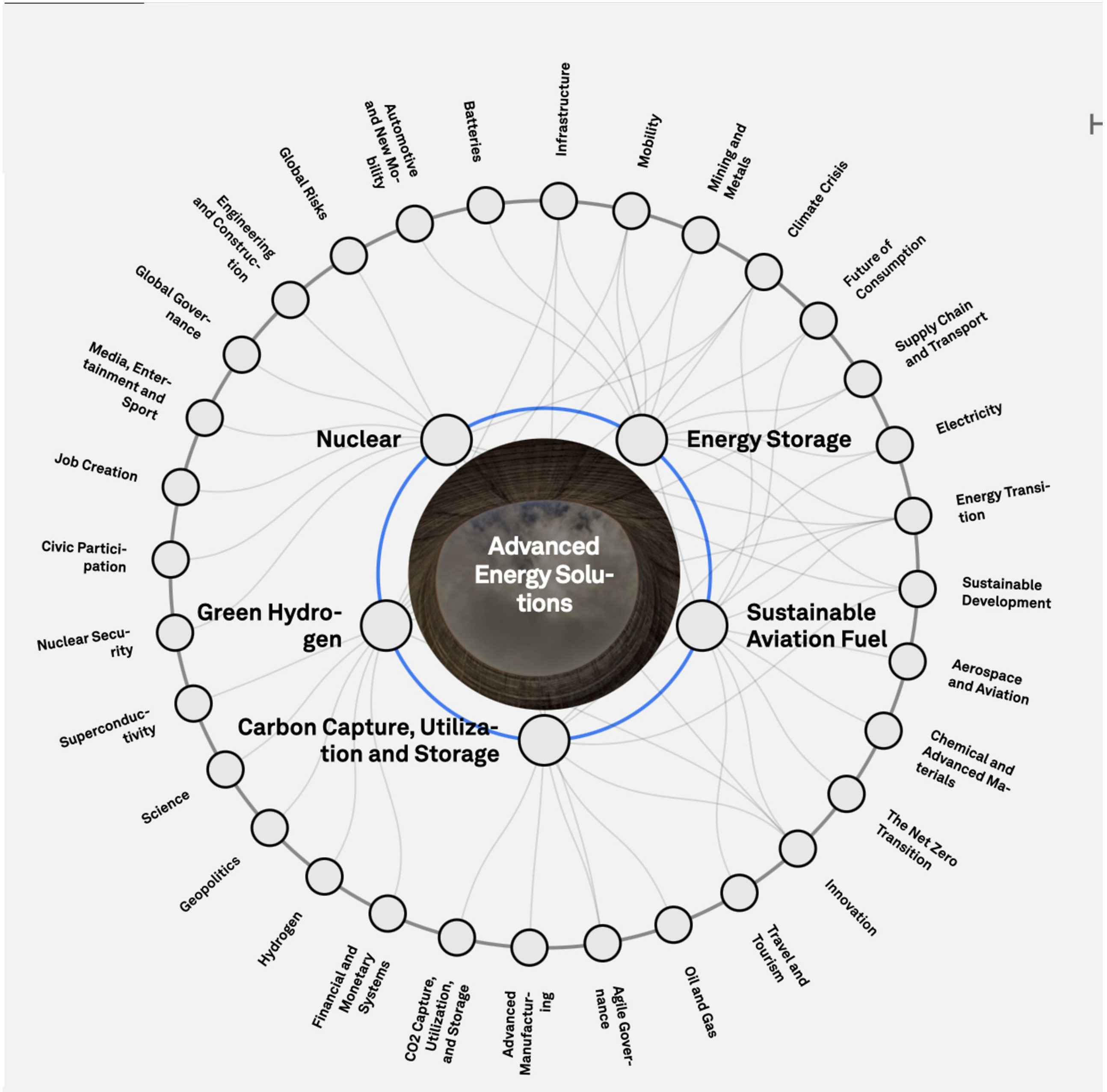
Curation
Created by Massachusetts Institute of Technology (MIT), licensed for personal/academic use only, not for reproduction.

Energy consumption and production account for about two-thirds of global greenhouse gas emissions, and 81% of the global energy mix is still based on fossil fuels - a percentage that has not budged in decades. A transition to a more inclusive, sustainable, affordable, and secure global energy system is imperative. This must be done while balancing the “energy triangle”: security and access, environmental sustainability, and economic development. And it must also now be done in a way that accounts for the impact of significant geopolitical friction. Public-policy and private-sector responses may affect the speed and shape of the energy transition to a zero-carbon-emissions future for years to come.

This Transformation Map is informed by the views of a wide range of experts from the World Economic Forum’s Expert Network and is curated in partnership with Scott Burger, Research Affiliate, Massachusetts Institute of Technology. The content does not necessarily reflect the views of the Forum.

ADVANCED ENERGY SOL.

WEF STRATEGIC INTELLIGENCE



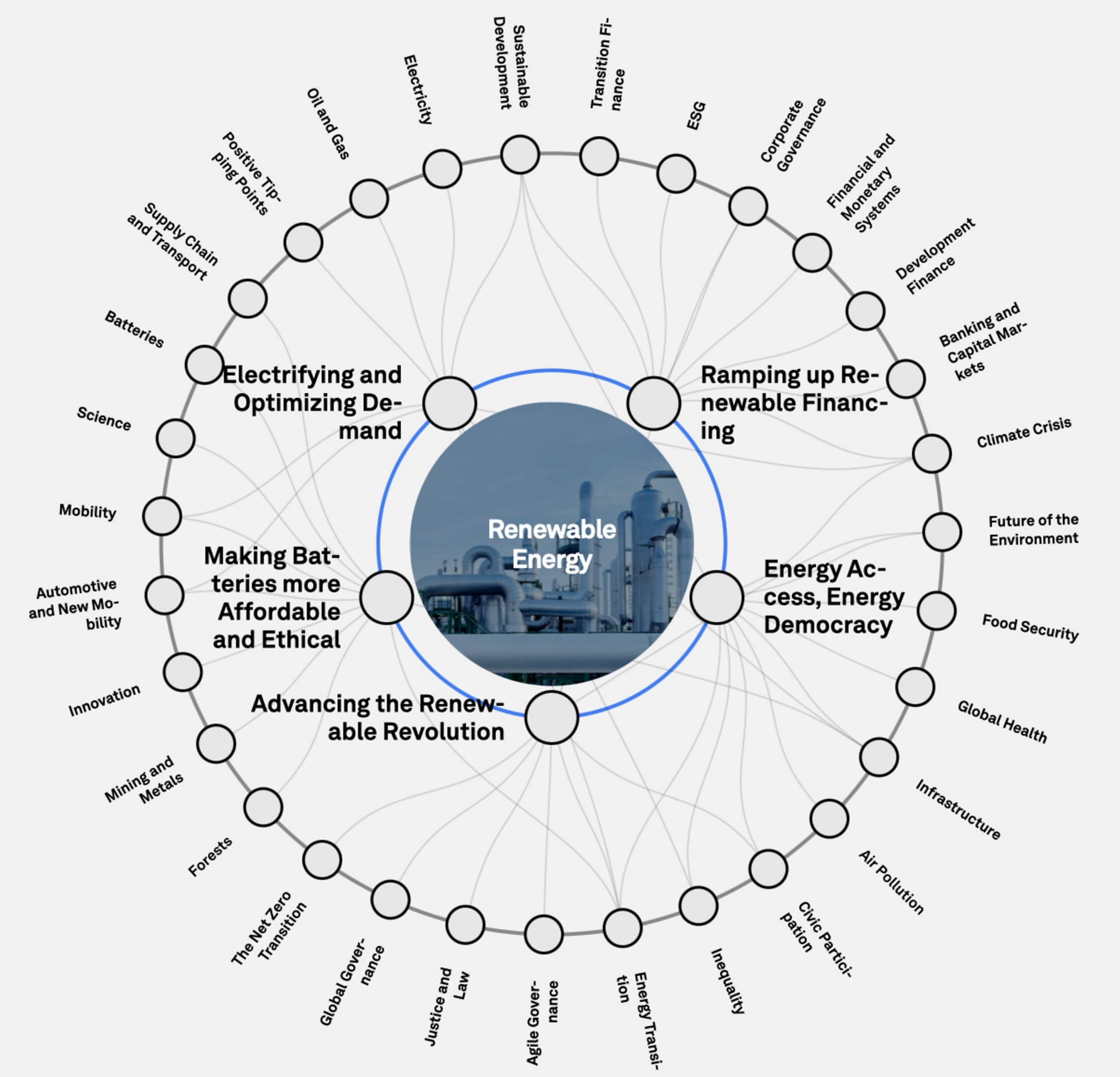
Curation
Created by Council on Energy, Environment and Water (CEEW), licensed for personal/academic use only, not for reproduction.

The bulk of countries around the world, including the heaviest emitters, have now set goals to achieve net-zero emissions - that is, eliminating greenhouse gas emissions to the greatest extent possible, while reabsorbing the remainder. In order to get there, new and emerging energy sources will be necessary, including green hydrogen, smaller-scale nuclear power, and sustainable aviation fuel, coupled with carbon-capture technologies. The private and public sectors have important related roles to play - in terms of investing, innovating, and facilitating.

This briefing is based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with The Council on Energy, Environment and Water (CEEW), a leading public policy think tank based in Delhi, India. The content does not necessarily reflect the views of the Forum.

RENEWABLE ENERGY

WEF STRATEGIC INTELLIGENCE



Curation

Created by University of Exeter, licensed for personal/academic use only, not for reproduction.

In the first half of 2024, renewable energy reached the point of accounting for nearly a third of the world's electricity. This increased use of solar and wind power, and the growing deployment of batteries for energy storage, are hastening a positive tipping point - a welcome threshold beyond which it should become more feasible to limit harmful global warming, and a reassuring counterbalance to the negative tipping points threatening Earth systems. Economies of scale, learning curves, and other self-reinforcing drivers of change have helped fuel the impressive growth of renewables to date. Now, greater international cooperation will be essential for financing and facilitating a further scaling up throughout the world.

This briefing is based on the views of a wide range of experts from the World Economic Forum's Expert Network and is curated in partnership with Professor Tim Lenton and Dr. Steve Smith at the Global Systems Institute, University of Exeter, in partnership with the Bezos Earth Fund. The content does not necessarily reflect the views of the Forum.

DIGITAL PERISCOPE 2018

NEW AND EMERGING TECHNOLOGIES 2018 - 2028

https://medium.com/@seanmoffitt/the-top-30-emerging-technologies-2018-2028-eca0dfb0f43c

DIGITAL PERISCOPE 2018 – NEW/EMERG. TECH

1. Artificial Intelligence #AI / Machine Learning / Deep Learning
2. Internet of Things #IOT / #IIOT & Sensors & Wearables
3. Mobile & Social Internet — Advancements, Social Networks / Media, Search, Messaging and Livestreams
4. Blockchain — Cryptocurrencies, Distributed Ledger Systems, DAOs, DApps
5. Big Data — Apps, Infrastructure & Predictive Analytics
6. Automation — Information, Task, Process, Machine, Decision & Action
7. Robots incl. Drones & Autonomous Vehicles — Consumer/Commercial/Industrial Robots and Robotics
8. Immersive Media — #VR / #AR / #MR / 360°
9. Mobile Technologies & Advancements — infrastructure, networks, standards, services & devices
10. Cloud Computing — Software-as-Service (SaaS), Infrastructure-as-a-Servcie (IaaS), Platform-as-a-Service (PaaS) & MESH Apps
11. 3D Printing — Additive Manufacturing and Rapid Prototyping
12. CX — Customer Journey, Experience, Personalization & Commerce Tools
13. EnergyTech — Efficiency, Storage & Decentralized Grid
14. Cybersecurity incl. Adaptive Security — Security, Intelligence Detection, Remediation & Adaptation
15. Voice Assistants -Interfaces, Chatbots & Natural Language Processing
16. Nanotechnology - Computing, Medicine, Machines + Smart Dust
17. CollaborativeTech — Crowd, Sharing, Workplace & Open Source Platforms & Tools
18. Health Tech — Advanced Genomics, Bionics & Health Care Tech.
19. Human-Computer Interaction — Facial/Gesture Recognition, Biometrics, Gaze Tracking
20. Geo-spatial Tech — GIS, GPS, Mapping & Remote Sensing, Scanning, Navigation
21. Advanced Materials — Composites, Alloys, Polymers, Biomimicry, Nanomanufacturing
22. New Touch Interfaces — Touch Screens, Haptics, 3D Touch, Paper, Feedback & Exoskeletons
23. Wireless Power
24. Clean Tech. — Bio-/Enviro-Materials + Solutions, Sustainability, Treatment & Efficiency
25. Quantum Computing — + Exascale Computing
26. Smart Cities — Infrastructure & Transport
27. Edge/Fog Computing
28. Faster, Better Internet — Broadband incl. Fiber, 5G, Li-Fi , LPN and LoRa
29. Proximity Tech. — Beacons, RFID, Wi-Fi, Near-Field Communications & Geofencing
30. New Screens — next evolution TVs, Digital Signage, OOH, MicroLEDS & Projections

NEW EMERGING TECHNOLGIES 2018 (1-4)

Artificial Intelligence #AI /Machine Learning / Deep Learning
[1]

Internet of Things #IOT / #IIOT & Sensors & Wearables
[2]

Mobile & Social Internet — Advancements, Social Networks / Media, Search, Messaging and Livestreams
[3]

Blockchain — Cryptocurrencies, Distributed Ledger Systems, DAOs, Dapps
[4]

NEW EMERGING TECHNOLGIES 2018 (5-8)

Big Data — Apps, Infrastructure & Predictive Analytics
[5]

Robots incl. Drones & Autonomous Vehicles — Consumer / Commercial / Industrial Robots and Robotics
[6]

Automation — Information, Task, Process, Machine, Decision & Action
[7]

Immersive Media — #VR / #AR / #MR / 360°
[8]

NEW EMERGING TECHNOLGIES 2018 (9-12)

Mobile Technologies & Advancements — infrastructure, networks, standards, services & devices
[9]

3D Printing — Additive Manufacturing and Rapid Prototyping
[10]

Cloud Computing — Software-as-Service (SaaS), Infrastructure-as-a-Servcie (IaaS), Platform-as-a-Service (PaaS) & MESH Apps
[11]

CX — Customer Journey, Experience, Personalization & Commerce Tools
[12]

NEW EMERGING TECHNOLGIES 2018 (13-16)

EnergyTech — Efficiency, Storage & Decentralized Grid
[13]

Voice Assistants -Interfaces, Chatbots & Natural Language Processing
[14]

Cybersecurity incl. Adaptive Security — Security, Intelligence Detection, Remediation & Adaptation
[15]

Nanotechnology - Computing, Medicine, Machines + Smart Dust
[16]

NEW EMERGING TECHNOLGIES 2018 (17-20)

CollaborativeTech — Crowd, Sharing, Workplace & Open Source Platforms & Tools [17]

Human-Computer Interaction — Facial/Gesture Recognition, Biometrics, Gaze Tracking [18]

Health Tech — Advanced Genomics, Bionics & Health Care Tech. [19]

Geo-spatial Tech — GIS, GPS, Mapping & Remote Sensing, Scanning, Navigation [20]

NEW EMERGING TECHNOLGIES 2018 (21-24)

Advanced Materials — Composites, Alloys, Polymers, Biomimicry, Nanomanufacturing [21]

Wireless Power [22]

New Touch Interfaces — Touch Screens, Haptics, 3D Touch, Paper, Feedback & Exoskeletons [23]

Clean Tech. — Bio-/Enviro-Materials + Solutions, Sustainability, Treatment & Efficiency [24]

NEW EMERGING TECHNOLGIES 2018 (25-28)

Quantum Computing — +
Exascale Computing
[25]

Edge/Fog Computing
[26]

Smart Cities — Infrastructure &
Transport
[27]

Faster, Better Internet —
Broadband incl. Fiber, 5G, Li-Fi ,
LPN and LoRa
[28]

NEW EMERGING TECHNOLGIES 2018 (29-30)

Proximity Tech. — Beacons, RFID, Wi-Fi, Near-Field Communications & Geofencing [29]

New Screens — next evolution TVs, Digital Signage, OOH, MicroLEDS & Projections [30]

TECHVISION 50

2024
Fifty Emerging Technologies and Materials That Will Shape the Future

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

TECHVISION 50: 2024

FIFTY EMERGING TECHNOLOGIES AND MATERIALS THAT WILL SHAPE THE FUTURE

1. Direct Air Carbon Capture and Storage (DACCS)
2. Personalized Medicine
3. Bio-based Energetics
4. Humanoid Robots
5. Sodium-ion Batteries
6. Quantum Sensors
7. MicroLED Displays
8. Brain-computer interfaces
9. Gridscale Wireless Energy Transmission and Charging
10. Quantum Computing
11. Industrial Metaverse
12. Post-quantum Cryptography
13. Quantum Dot short-wave infrared (SWIR) Sensing in AI and Machine vision
14. Biologically Inspired AI
15. 4D printing
16. Metamaterials
17. AI Chips
18. Hyperspectral Imaging
19. Millimetre wave and terahertz technologies
20. Green Hydrogen
21. Biomanufacturing
22. Biocatalysts
23. Soft Robotics
24. Shape Memory Materials
25. Materials Informatics
26. Transparent Electronics
27. Regenerative Agriculture
28. Bioprinting

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

TECHVISION 50: 2024

FIFTY EMERGING TECHNOLOGIES AND MATERIALS THAT WILL SHAPE THE FUTURE

29. RNA Therapeutics
30. Neuromorphic Computing
31. Conductive Carbon Nanomaterials
32. Liquid Metal Alloys
33. Advanced Ceramics
34. Mycelium Composites
35. Self-Healing Materials
36. Transparent Solar Panels
37. Chemical Recycling
38. Photonic Integrated Circuits (PICs)
39. Carbon Removal Concrete
40. Edible Coatings
41. Metal-Organic Frameworks (MOFs)
42. Bio-based and Degradable Batteries
43. Synthetic Biology
44. Generative Biology
45. Quantum Batteries
46. Agrivoltaics
47. Wearable Energy Harvesting
48. Perovskite Materials
49. Antibody-drug conjugates (ADCs)
50. Heat Batteries

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

DIRECT AIR CARBON CAPTURE+ (DACCS) – [1]

What is it? Direct Air Carbon Capture and Storage (DACCS) involves capturing carbon dioxide (CO2) directly from the atmosphere and storing it securely, typically underground. This process is designed to reduce the amount of CO2 in the atmosphere. DACCS is considered a form of negative emissions technology, as it actively removes CO2 from the air. The main technologies used in DACCS include Absorption-based systems (chemical sorbents, moisture swings), Adsorption-based systems (Solid sorbents, temperature swings, pressure swings), Membrane-based systems, Electrochemical systems (fuel cells), Cryogenic separation, Geological storage, and Mineral carbonation.

Why is it important? DACCS can help reduce atmospheric CO2 levels and help to achieve net zero targets. DACCS can play a significant role in offsetting emissions from hard-to-abate sectors, such as aviation and agriculture. Unlike some other carbon capture methods, DACCS can remove CO2 that has already been emitted, making it a valuable tool for addressing the cumulative effects of past emissions.

What industries will it impact? Energy (integrated with power plants), Oil & Gas, Manufacturing, Transportation, Agriculture, Carbon markets and trading, Waste management.

Markets players: Airhive, CarbonCapture Inc., Climeworks, Mission Zero Technologies, Noya.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

PERSONALIZED MEDICINE – [2]

What is it? Personalized medicine (aka precision medicine) that tailors medical treatments, practices, and decisions to the individual patient based on their genetic profile, lifestyle, and environment. The goal of personalized medicine is to optimize treatment outcomes, minimize side effects, and improve overall patient care by considering each person's unique characteristics. Technologies used in personalized medicine include Genomic sequencing, Pharmacogenomics, Biomarker analysis, Molecular imaging, Big data analytics, Machine learning and artificial intelligence and Wearable devices and remote monitoring, all allowing for the collection of real-time data on patients' health, enabling personalized interventions and treatment adjustments.

Why is it important? Personalized medicine allows for improved treatment outcomes, early disease detection and prevention, reduces healthcare costs by avoiding unnecessary treatments and focusing on targeted therapies, encourages patients to take an active role in their health by providing them with information specific to their genetic profile and lifestyle factors.

What industries will it impact? Pharma & Biotech, Diagnostics & Testing, Healthcare, Data Analytics, Wearable Tech & Digital Health

Markets players: Quest Diagnostics, Exact Sciences, Qiagen, SomaLogic, OneOme, PacBio, Acrivon Therapeutics, Empiriko, SpringWorks Therapeutics, Scorpion Therapeutics, ReCode Therapeutics, Engine Biosciences, Biomea Fusion, Alto Neuroscience, AC Immune.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

BIO-BASED ENERGETICS – [3]

What is it? Bio-based energetic materials (Bio-EM) utilizes energy-dense materials derived from renewable biological sources. These materials can be used as propellants, explosives, or pyrotechnics, offering a more sustainable and environmentally friendly alternative to traditional petroleum-based energetics, with interest growing of late in the mining sector. Compounds extracted from biomass, such as cellulose, hemicellulose, and lignin, can be used to synthesize energetic materials, and nitrocellulose, a highly flammable compound derived from cellulose, is used in propellants and explosives. High-energy-density bio-based oils and other compounds are also being developed for energetic applications.

Why is it important? Bio-based energetics derived from renewable resources, reduce dependence on finite fossil fuels in already polluting industries. In the synthesis of energetic materials, large amounts of strong acids and hazardous solvents are often required. Significant quantities of waste are produced and in many cases these waste materials are contaminated with toxic metals or with EM and thus require special disposal methods. Processing of EM into propellants explosives or pyrotechnics can be both hazardous and waste producing.

What industries will it impact? Defense and military, Aerospace, Mining, Fireworks and pyrotechnics, Agriculture.

Markets players: Mainly at the research stage, however bio-based energetic materials is a potentially large growth industry in mining and oil & gas.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

HUMANOID ROBOTICS – [4]

What is it? Humanoid robotics focuses on the development of robots with human-like appearance and capabilities. These robots are designed to interact with humans and perform tasks in human environments, such as homes, offices, and public spaces. AI algorithms enable humanoid robots to learn, adapt, and make decisions based on their environment and interactions with humans. Machine learning techniques allow humanoid robots to improve their performance over time by learning from data and experiences. Advanced computer vision systems are enabling humanoid robots to perceive and interpret their surroundings, recognizing objects, faces, and gestures. Humanoid robots are equipped with a variety of sensors (e.g., cameras, microphones, touch sensors) and actuators (e.g., motors, hydraulics) that enable them to sense and interact with their environment. Specialized control systems and algorithms enable humanoid robots to walk and maintain balance on two legs, mimicking human gait and movement. Natural language processing (NLP) technologies allow humanoid robots to understand and respond to human speech, facilitating more natural human-robot interaction.

Why is it important? The use humanoid robots can be designed to assist humans in various settings, performing tasks that may be difficult, dangerous, or time-consuming for humans.

What industries will it impact? Manufacturing (e.g. Automotive), Logistics, Retail, Healthcare, Construction, Defence

Markets players: FIGURE, Agility Robotics, XPENG Robotics, Boston Dynamics, Oversonic Robotics, Rainbow Robotics, Apptronik

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

SODIUM-ION BATTERIES – [5]

What is it? Sodium-ion batteries have gained attention as a potential alternative to lithium-ion batteries due to the abundance and low cost of sodium resources.Commercialization of SIB is moving much faster than was originally expected and they will be key components in Small Electric Vehicle (EV) and Long-duration Energy Storage applications. Among other advantages over incumbent Lithium-ion batteries (LIB), SIBs offer lower raw material costs and sustainability.

Why is it important? Sodium is more abundant and widely distributed than lithium, making sodium-ion batteries potentially cheaper to produce than lithium-ion batteries. The abundance of sodium resources also makes sodium-ion batteries a more sustainable long-term option for energy storage, especially as the demand for batteries continues to grow. They are also well-suited for large-scale energy storage applications, such as grid storage.

What industries will it impact? Electric vehicles, Grid energy storage, Consumer electronics, Renewable energy, Telecommunications.

Markets players: Altris AB, CATL, Faradion, HiNa Battery, Kite Rise Technologies GmbH, Natron Energy, Tiamat Energy, Weifang Energy

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

QUANTUM SENSORS – [6]

What is it? Quantum sensors are highly sensitive and precise measurement devices that exploit quantum phenomena, such as entanglement, superposition, and interference, to detect and measure physical quantities with unprecedented accuracy. These sensors can measure various parameters, including magnetic fields, electric fields, gravity, temperature, and pressure, with far greater sensitivity than traditional sensors.

Why is it important? Quantum sensors can provide measurements with unprecedented accuracy, enabling the detection of previously unmeasurable phenomena and enhancing the performance of existing sensing technologies. The enhanced sensitivity of quantum sensors can lead to new insights in various fields, such as fundamental physics, materials science, and biology.

What industries will it impact? Healthcare and medical imaging, Aerospace and defense, Automotive, Oil and gas exploration, Telecommunications, Environmental monitoring: Quantum sensors can be used to monitor environmental parameters, such as air and water quality, with unprecedented sensitivity and accuracy.

Markets players: Gigajot, Qnami, QLM, Infleqtion, QuantumDiamonds, Bosch.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

MICROLED DISPLAYS – [7]

What is it? Micro-LED (µLED) displays are advanced flat-panel display technology that uses microscopic light-emitting diodes (LEDs) as individual pixel elements. These LEDs, typically less than 100 micrometers in size, offer several advantages over traditional display technologies like LCD and OLED).

Why is it important? Micro-LED displays can achieve much higher brightness levels and contrast ratios compared to LCD and OLED displays, resulting in more vivid and lifelike images. Micro-LEDs can produce a wider range of colors, enabling more accurate and vibrant color reproduction. They are highly efficient, requiring less power than traditional display technologies, which is particularly beneficial for battery-powered devices. Micro-LEDs have a longer lifespan and are more resistant to image retention and burn-in compared to OLED displays.

What industries will it impact? Consumer electronics, Automotive, Virtual and augmented reality (VR/AR), Digital signage and large-scale displays, Medical devices, Aerospace and defense.

Markets players: Innolux, Jade Bird Display, Kopin, Kubos Semiconductors, LG Display, MICLEDI, Mikro Mesa, Mojo Vision, PlayNitride, Porotech, Raysolve Technology, Q-Pixel, Samsung Electronics, Tianma, Sony.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

BRAIN-COMPUTER INTERFACES – [8]

What is it? Brain-computer interfaces (BCIs), also known as brain-machine interfaces (BMIs), are systems that establish a direct communication pathway between the human brain and an external device or computer. BCIs read, interpret, and translate brain signals into commands that can control devices or communicate with the outside world, enabling a new form of human-machine interaction.

Why is it important? BCIs can restore communication and control capabilities for individuals with severe motor disabilities, such as those with amyotrophic lateral sclerosis (ALS), spinal cord injuries, or locked-in syndrome. BCIs can be used in neurorehabilitation to help patients recover motor functions after stroke, traumatic brain injury, or other neurological disorders. They have the potential to enhance human cognitive and sensory abilities, such as improving memory, attention, or perception, and enabling new forms of human-machine collaboration.

What industries will it impact? Manufacturing (e.g. Automotive), Logistics, Retail, Healthcare, Construction, Defence

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

Markets players: Google, Ceribell, Kernel, MindMaze, ni2o, NeuroPace, Neuralink, Intel, Petal, BrainQ, NURO, IBM, Kernel, Paradromics, Metaviz.

GRIDSCALE WIRELESS ENERGY TR. & CHARGING – [9]

What is it? Gridscale Wireless Energy Transmission and Charging (GWETC) aims to enable the wireless transmission of electrical energy over long distances, potentially revolutionizing the way we distribute and consume electricity. This technology could allow for the efficient and flexible transmission of power from renewable energy sources to consumers, as well as the wireless charging of electric vehicles and other devices. Technologies and materials used in GWETC include Microwave power transmission, Laser power transmission, Magnetic resonance coupling, Rectenna (rectifying antenna), Metamaterials and High-temperature superconductors.

Why is it important? GWETC could enable the efficient transmission of electricity from lrge-scale renewable energy sources, such as offshore wind farms or solar power plants, to consumers, reducing transmission losses and infrastructure costs. Wireless energy transmission can provide greater flexibility in the placement of power generation and consumption sites, as well as improve the resilience of the electricity grid by reducing dependence on physical transmission lines. GWETC could also enable the wireless charging of electric vehicles while in motion, eliminating the need for frequent stops at charging stations and increasing the adoption of electric transportation.

What industries will it impact? Energy and utilities, Transportation and automotive, Aerospace and space exploration, Internet of Things (IoT) and smart cities, Healthcare and medical devices, Consumer electronics.

Markets players: Emrod, Siemens, Qualcomm, Apple, Canon, WiTricity, Panasonic, Samsung Electronics.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

QUANTUM COMPUTING – [10]

What is it? Quantum computing harnesses the principles of quantum mechanics to perform complex computations that are beyond the capabilities of classical computers. Unlike classical computers, which use bits that can be either 0 or 1, quantum computers use quantum bits (qubits) that can exist in multiple states simultaneously, a property known as superposition. This enables quantum computers to perform certain computations exponentially faster than classical computers.

Why is it important? Quantum computers can solve certain problems, such as optimization, simulation, and machine learning tasks, exponentially faster than classical computers. Quantum computers can simulate complex molecular systems, accelerating the discovery of new drugs and materials. They can break many current encryption methods, driving the development of new, quantum-resistant cryptographic systems.

What industries will it impact? Pharmaceuticals and healthcare, Finance and banking, Cybersecurity and cryptography, Aerospace and defense, Energy and materials, Transportation and logistics, Telecommunications.

Markets players: Algorithmiq, Infleqtion, IonQ, Kipu Quantum, Multiverse Computing, Nu Quantum, Origin Quantum, Oxford Ionics, QuantWare, Quantagonia, QuantrolOx, Quantum Motion, Qunnect, SCALINQ, TuringQ and Welinq.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

INDUSTRIAL METAVERSE – [11]

What is it? The industrial metaverse involves convergence of the physical and digital worlds in an industrial setting. It involves creating a virtual representation of an industrial environment, such as a factory, warehouse, or supply chain, where real-time data from various sources, including sensors, machines, and systems, is integrated and visualized in a 3D, immersive, and interactive manner. This virtual environment enables remote monitoring, optimization, simulation, and collaboration, leading to improved efficiency, productivity, and decision-making in industrial processes. Enabling technologies include I, nternet of Things (IoT) sensors and devices, 5G and edge computing, Artificial intelligence (AI) and machine learning (ML), VR and AR, Digital twin platforms, Blockchain and distributed ledger technologies (DLT), and Advanced robotics and automation.

Why is it important? The industrial metaverse enables real-time monitoring, optimization, and predictive maintenance of industrial processes, leading to reduced downtime, increased output, and lower costs. Immersive virtual environments allow remote teams to collaborate seamlessly, access expert knowledge, and make informed decisions, regardless of their physical location. Virtual simulations and digital twins enable rapid prototyping, testing, and optimization of new products and processes, reducing time-to-market and fostering innovation. The industrial metaverse also enables realistic, risk-free training and education in virtual environments, improving workforce skills and safety.

What industries will it impact? Manufacturing, Logistics & SCM, Energy & utilities, Healthcare & pharmaceuticals, Construction & architecture, Aerospace & defense, Agriculture & food production.

Markets players: Nvidia, Meta, Microsoft, Hexagon, NavVis, Siemens.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

POST-QUANTUM CRYPTOGRAPHY – [12]

What is it? Post-quantum cryptography (PQC), also known as quantum-resistant cryptography, is a field of cryptography that focuses on developing cryptographic algorithms that are secure against attacks by both classical and quantum computers. As quantum computers become more powerful, they pose a significant threat to current cryptographic systems, which rely on mathematical problems that are difficult for classical computers to solve but can be easily solved by quantum computers using Shor's algorithm. Post-quantum cryptography aims to develop new cryptographic algorithms that are resistant to these quantum attacks.

Why is it important? As quantum computers become more powerful, they threaten the security of current cryptographic systems. Post-quantum cryptography ensures that sensitive data remains secure in the face of quantum computing advancements. Post-quantum cryptography is crucial for protecting critical infrastructure, such as financial systems, power grids, and communication networks, from quantum-based attacks. PQC helps preserve the privacy and confidentiality of sensitive information, such as personal data, health records, and intellectual property, in the quantum computing era. Post-quantum cryptography ensures that secure communication channels, such as those used in messaging apps, email, and virtual private networks (VPNs), remain uncompromised by quantum attacks.

What industries will it impact? Finance and banking, Government and defense, Healthcare and medical devices, Telecommunications and IoT, Cybersecurity and IT services, Cloud computing and data storage, Automotive and transportation.

Markets players: CryptoNext, EvolutionQ, ID Quantique, KEEQuant GmbH.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

QUANTUM DOT SHORT-WAVE IR+ (SWIR) – [13]

SENSING IN AI AND MACHINE VISION

What is it? Quantum Dot short-wave infrared (SWIR) sensing combines the unique properties of quantum dots with the short-wave infrared spectrum (typically 0.9-2.5 μm) to enhance the capabilities of artificial intelligence (AI) and machine vision systems. Quantum dots are nanoscale semiconductor particles that can absorb and emit light at specific wavelengths, allowing for highly sensitive and tunable optical sensing.

Why is it important? In AI and machine vision, SWIR sensing offers several advantages over traditional visible light and near-infrared (NIR) sensing including Improved visibility in challenging conditions, Material and object identification, Reduced interference from visible light and Enhanced contrast and depth perception. Quantum dot SWIR sensing can improve the ability of AI systems to identify, classify, and differentiate materials and objects based on their unique SWIR signatures.

What industries will it impact? The unique capabilities of SWIR sensing enable AI and machine vision systems to be applied in a wider range of industries and use cases, from manufacturing quality control to autonomous vehicles and beyond. Industries impacted include Automotive and transportation, Agriculture and food production, Manufacturing and quality control, Defense and security, Healthcare and medical imaging, Environmental monitoring and remote sensing, Robotics and automation.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

Markets players: Quantum Solutions, STMicroelectronics, Quantum Science.

BIOLOGICALLY INSPIRED AI – [14]

What is it? Biologically Inspired AI, also known as bio-inspired AI or biomimetic AI, is an approach to artificial intelligence that draws inspiration from the principles, structures, and processes found in biological systems. This field focuses on developing AI algorithms, architectures, and systems that mimic or adapt the problem-solving strategies observed in nature, such as those found in the brain, immune system, or evolutionary processes. Key aspects of Biologically Inspired AI include Neural networks, Evolutionary algorithms, Swarm intelligence, Artificial immune systems and Neuromorphic computing.

Why is it important? Bio-inspired AI systems can exhibit robust and adaptive behavior in the face of uncertainty, noise, and changing environments, similar to how biological systems operate in the real world. Many biological systems are highly energy-efficient, and bio-inspired AI approaches, such as neuromorphic computing, can lead to the development of more energy-efficient AI hardware and algorithms. Biological systems, like the brain, demonstrate massive parallel processing capabilities. Bio-inspired AI approaches can enable the development of highly scalable and parallel AI systems.

What industries will it impact? What industries will it impact? Healthcare and biomedical research, Robotics and autonomous systems, Environmental monitoring and conservation, Transportation and logistics, Cybersecurity and anomaly detection, Manufacturing and engineering, Finance.

Markets players: Brainchip, Meta.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

4D PRINTING – [15]

What is it? 4D printing combines the principles of 3D printing with smart materials that can change shape, properties, or functionality over time in response to external stimuli. This adds a fourth dimension – time – to traditional 3D printing, allowing for the creation of dynamic, adaptive, and self-transforming structures.

Why is it important? 4D printing enables objects that can change functionality or properties over time, allowing for more adaptive systems. 4D-printed objects can self-assemble into complex structures or self-repair when damaged, reducing the need for manual intervention. By programming the desired transformation into the material, 4D printing can simplify mechanical systems and eliminate the need for additional components.

What industries will it impact? Aerospace and automotive, Biomedical and healthcare, Robotics and soft robotics, Construction and architecture, Fashion and textiles, Packaging and logistics, Energy and environmental systems.

Markets players: HP, Stratasys, Optomec, Markforged . Mainly players from the broader 3D printing industry leveraging their additive manufacturing expertise.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

METAMATERIALS – [16]

What is it? Metamaterials are artificially engineered structures with exceptional material properties (acoustic, electrical, magnetic, optical, etc.). They comprise arrays of resonators that manipulate electromagnetic waves or sound in ways not normally found in nature. Possessing customized dielectric properties and tunable responses they allow for excellent flexibility in a range of applications, their use enabling the manipulation of fields and waves at a subwavelength scale.

Why is it important? Metamaterials allow for unprecedented control over the propagation, absorption, and manipulation of electromagnetic and acoustic waves. They can enable the miniaturization and integration of advanced functionalities into compact devices, such as antennas, sensors, or optical components. Metamaterials can enable new functionalities, such as cloaking, super-resolution imaging, or perfect absorption, which have the potential to revolutionize various fields. By tailoring the properties of metamaterials, the performance of devices and systems in terms of efficiency, sensitivity, or bandwidth can be significantly enhanced.

What industries will it impact? Telecommunications and Wireless Communication, Aerospace and Defense, Electronics and Computing, Optics and Photonics, Energy, Healthcare and Medical Devices, Automotive, Consumer Electronics.

Markets players: Anywaves, Breylon, Echodyne, Inc., Evolv Technologies, Inc., Fractal Antenna Systems, Inc, Imagia, Kymeta Corporation, Lumotive, OPT Industries, Phononic Vibes srl, Metamaterial, Inc., Metawave Corporation.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

AI CHIPS – [17]

What is it? AI chips, also known as AI accelerators or AI processors, are specialized computer chips designed to efficiently perform the complex mathematical computations required for artificial intelligence (AI) and machine learning (ML) tasks. These chips are optimized for the parallel processing of large amounts of data, enabling faster and more efficient AI computations compared to traditional CPUs.

Why is it important? AI chips can greatly accelerate the training and inference of AI models, reducing the time and computational resources required. AI chips are designed to perform AI tasks with high energy efficiency, which is crucial for applications in edge devices and data centers. By improving performance and energy efficiency, AI chips can help reduce the overall cost of AI deployments. The increased computational power and efficiency provided by AI chips can enable new and more sophisticated AI applications across various industries.

What industries will it impact? Consumer electronics, Automotive, Healthcare, Finance, Cloud computing, Robotics.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

Markets players: AMD, Astrus, Celestial AI, Cerebras, d-Matrix, DEEPX, EdgeCortix® Inc., Etched.ai, Enfabrica, Enflame, Google, Horizon Robotics, IBM, Kneron, Lightmatter, Neuchips, Nvidia, Panmnesia, Rebellions, Samsung.

HYPERSPECTRAL IMAGING – [18]

What is it? Hyperspectral imaging (HSI) is an advanced imaging technique that captures and processes data from across the electromagnetic spectrum, including visible, near-infrared, and short-wave infrared regions. Unlike traditional imaging methods that capture data in a limited number of spectral bands, hyperspectral imaging captures hundreds or even thousands of narrow spectral bands, providing detailed spectral information for each pixel in an image.

Why is it important? HSI enables the identification and characterization of materials based on their unique spectral signatures, even when they are visually similar, allowing for non-destructive testing and analysis. Hyperspectral imaging from airborne or satellite platforms allows for the detailed mapping and monitoring of land cover, vegetation health, water quality, and other environmental factors. HSI can be used to monitor and control industrial processes, ensuring product quality and detecting defects or contaminants that may not be visible to the naked eye.

What industries will it impact? Agriculture and forestry, Environmental monitoring, Mining and geology, Oil and gas, Food and beverage, Pharmaceuticals, Defense and security.

Markets players: NEO, Pixxel.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

MM WAVE AND TERAHERTZ TECHNOLOGIES – [19]

What is it? Millimeter Wave (mmWave) and Terahertz (THz) technologies refer to the use of electromagnetic waves with frequencies in the millimeter wave (30-300 GHz) and terahertz (0.1-10 THz) ranges, respectively. These high-frequency waves have unique properties that make them suitable for various applications, including high-speed wireless communication, imaging, and sensing.

Why is it important? mmWave technology is a key enabler for 5G and future 6G wireless networks, providing high-bandwidth, low-latency connectivity for applications like virtual reality, autonomous vehicles, and the Internet of Things (IoT). THz waves can penetrate many non-conductive materials, allowing for non-invasive inspection and imaging in industries such as manufacturing, construction, and healthcare. Many chemicals and biological substances have unique spectral signatures in the THz range, enabling the development of highly sensitive and selective sensing applications. THz waves can detect concealed weapons, explosives, and other threats, enhancing security in public spaces, airports, and other critical infrastructure.

What industries will it impact? Telecommunications, Automotive, Healthcare, Aerospace and defense, Manufacturing, Security and surveillance, Food and agriculture.

Markets players: Movandi, Apple, Ericsson, LG Electronics, META, Nokia, NTT Corporation, Samsung, SK Telecomm.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

GREEN HYDROGEN – [20]

What is it? Green hydrogen is hydrogen produced using renewable energy sources, such as solar, wind, or hydro power, to electrolyze water into hydrogen and oxygen. Unlike traditional hydrogen production methods that rely on fossil fuels, green hydrogen offers a clean, sustainable, and low-carbon alternative.

Why is it important? Green hydrogen can significantly reduce greenhouse gas emissions by replacing fossil fuels in various sectors, contributing to global efforts to mitigate climate change. Hydrogen can be used as a long-term energy storage solution, helping to balance the intermittency of renewable energy sources and ensuring a stable and reliable energy supply. Green hydrogen can facilitate the integration of renewable energy across different sectors, such as transportation, industry, and buildings, enabling a more efficient and sustainable energy system.

What industries will it impact? Energy, Transportation, Manufacturing, Agriculture.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

Markets players: Advanced Ionics, Aker Horizons, C-Zero, Dynelectro, Ekona Power, Electric Hydrogen, Enapter, EvolOH, FuelCell Energy, Heliogen, HiiROC, Hystar, HydrogenPro, Innova Hydrogen, Thyssenkrupp Nucera.

BIOMANUFACTURING – [21]

What is it? The biomanufacturing market is a rapidly growing sector that involves the production of various products using biological systems, such as living cells, enzymes, or other biological components. The market encompasses a wide range of applications, from biopharmaceuticals and industrial enzymes to biofuels and bio-based chemicals. Biomanufacturing processes often rely on renewable feedstocks and generate less waste compared to traditional chemical manufacturing methods. This makes biomanufacturing a more sustainable and environmentally friendly approach to producing various products.

Why is it important? Biomanufacturing often relies on renewable feedstocks and can generate products with reduced environmental impact compared to traditional chemical manufacturing. Living systems can create complex molecules and materials that may be difficult or impossible to produce using conventional chemical synthesis. Biomanufacturing can be more cost-effective than traditional methods for certain products, as living cells can efficiently convert raw materials into desired products. Biological systems can produce molecules with high specificity and purity, which is particularly important for pharmaceutical applications.

What industries will it impact? Pharmaceuticals, Chemical industry, Energy, Food and agriculture.

Markets players: Aanika Biosciences, Amyris, BBGI, Biovectra, Bucha Bio, Byogy Renewables, Cascade Biocatalysts, Constructive Bio, Debut Biotechnology, Enginzyme AB,Ginkgo Bioworks, Hyfé, Invizyne Technologies, LanzaTech, Lygos, Mammoth Biosciences, Solugen.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

BIOCATALYSTS – [22]

What is it? Biocatalysts are enzymes or whole cells that are used to catalyze chemical reactions in various industrial processes. These biological catalysts are derived from living organisms and offer several advantages over traditional chemical catalysts, such as high specificity, mild reaction conditions, and reduced environmental impact.

Why is it important? Biocatalysts offer a more sustainable and environmentally friendly alternative to traditional chemical catalysts, reducing energy consumption, waste generation, and the use of harsh chemicals. The high specificity of biocatalysts enables the production of high-quality, pure compounds with fewer byproducts and impurities. Biocatalytic processes can be more cost-effective than traditional chemical processes, due to reduced energy requirements, simplified downstream processing, and the ability to use renewable feedstocks.

What industries will it impact? Pharmaceutical and biotech, Food and beverage, Chemical and materials, Agriculture and animal feed, Biofuels and bioenergy.

Markets players: Aether Bio, Basecamp Research, Cascade Biocatalysts, Constructive Bio, Debut Biotechnology, Enginzyme AB, eversyn, FabricNano, Johnson Matthey, Novozymes A/S and Protein Evolution.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

SOFT ROBOTICS – [23]

What is it? Soft robotics focuses on the design, fabrication, and control of robots made from soft, flexible, and compliant materials, such as silicone, rubber, or fabric. Unlike traditional rigid robots, soft robots can adapt to their environment, interact safely with humans, and perform delicate tasks.

Why is it important? Soft robots can interact safely with humans due to their inherent compliance and lack of sharp edges or rigid components, making them suitable for applications in healthcare, assistive technology, and collaborative work environments. Soft robots can adapt to unstructured and dynamic environments, navigate through confined spaces, and recover from collisions or deformations, making them more resilient than traditional rigid robots. The compliance and dexterity of soft robots enable them to perform delicate manipulation tasks, such as handling fragile objects or interacting with soft tissues, which is difficult for rigid robots.

What industries will it impact? Healthcare and biomedical, Manufacturing and assembly, Agriculture and Food Processing, Marine.

Markets players: Mementis, Soft Robotics, Soft Robot Tech, Spectroplast, Squishy Robotics.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

SHAPE MEMORY MATERIALS – [24]

What is it? Shape memory materials are smart materials that can return to their original shape after being deformed, when subjected to an external stimulus such as heat, light, or magnetic fields. These materials "remember" their pre-deformed shape and can recover it even after undergoing significant deformations.

Why is it important? Shape memory materials can be used to create smart structures and actuators that respond to external stimuli, enabling adaptive and self-regulating systems. Shape memory materials can be used to create medical devices that can be easily inserted into the body in a compact form and then deployed to their functional shape, minimizing patient trauma. The ability of shape memory materials to recover their shape after deformation allows for the creation of lightweight, compact, and deployable structures, reducing material usage and storage space.

What industries will it impact? Aerospace and automotive, Biomedical and healthcare, Robotics and automation, Consumer products, Construction and civil engineering.

Markets players: Kebotix, Matelligence, Awaji Materia Co., Ltd., Furukawa Electric Group, Maruho Hatsujyo Kogyo Co., Ltd., Nippon, re-fer AG, The Smart Tire Company, VenoStent

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

MATERIALS INFORMATICS – [25]

What is it? Materials informatics is an interdisciplinary field that combines materials science, data science, and computational methods to accelerate the discovery, design, and optimization of materials. It involves the application of data-driven approaches, such as machine learning and artificial intelligence, to materials datasets to identify patterns, predict properties, and guide the development of new materials.

Why is it important? Materials informatics enables the rapid exploration of vast material design spaces, identifying promising candidates and reducing the need for extensive experimental trials. Data-driven approaches can uncover complex relationships between material structures, processing conditions, and properties, providing new insights into material behaviour and performance. By accelerating the materials development process, materials informatics can help reduce research and development costs and bring new materials to market faster.

What industries will it impact? Chemical and materials manufacturing, Pharmaceutical and biomedical, Energy and sustainability, Aerospace and automotive, Electronics and semiconductors.

Markets players: Alchemy Cloud, Cynora, Kebotix, Kyulux, OTI Lumionics, Uncountable.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

TRANSPARENT ELECTRONICS – [26]

What is it? Transparent electronics enables the creation of devices with novel form factors and functionalities, such as transparent displays, solar cells, and sensors.

Why is it important? Transparent electronics allows for the integration of electronic functionality into various surfaces, such as windows, windshields, and eyewear, creating new possibilities for product design and user interaction. Transparent electronic components can be combined with traditional opaque electronics to create multifunctional devices that offer both transparency and electronic functionality. Transparent displays and sensors can provide users with information and interactivity without obstructing their view, enhancing the user experience in various applications.

What industries will it impact? Consumer electronics, Automotive, Architecture and building materials, Aviation and aerospace, Healthcare, Advertising and retail, Military and defenseras.

Markets players: LG Electronics, Lenovo.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

REGENERATIVE AGRICULTURE – [27]

What is it? Regenerative agriculture is a holistic approach to farming and land management that aims to restore and enhance the health of soil, ecosystems, and communities. It focuses on rebuilding soil organic matter, increasing biodiversity, and promoting the natural cycles of carbon, water, and nutrients, while producing high-quality, nutrient-dense food. Regenerative agriculture practices, such as cover cropping, crop rotation, and reduced tillage, aim to improve soil structure, increase organic matter, and enhance soil microbial activity.

Why is it important? Regenerative agriculture practices can help restore degraded land, reduce erosion, improve water retention and quality, and enhance biodiversity, promoting long-term environmental sustainability. / Climate change mitigation: By sequestering carbon in the soil and reducing greenhouse gas emissions from agriculture, regenerative practices can contribute to global efforts to mitigate climate change. / Food security and nutrition: Regenerative agriculture can improve soil fertility and produce more nutrient-dense food, enhancing food security and nutrition for a growing global population.

What industries will it impact? -

Markets players: Regrow.ag, Chrysalabs, constellr, Cargill, AgriCapture, Indigo Ag, Loam Bio

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

BIOPRINTING – [28]

What is it? Bioprinting is an additive manufacturing technique that uses bioinks, which contain living cells and biomaterials, to create three-dimensional (3D) biological structures layer by layer. This technology enables the fabrication of complex, functional tissues and organs for various applications, including regenerative medicine, drug testing, and biological research.

Why is it important? Bioprinting has the potential to revolutionize regenerative medicine by enabling the creation of functional tissues and organs for transplantation, addressing the shortage of donor organs and reducing the risk of immune rejection. Bioprinted tissues can serve as more accurate and physiologically relevant models for drug screening and toxicity testing, reducing the need for animal testing and improving the efficiency of drug development. Bioprinting enables the fabrication of in vitro tissue models that closely mimic native biological structures and functions, providing new insights into tissue development, disease mechanisms, and regenerative processes.

What industries will it impact? Healthcare and medical devices, Pharmaceutical and biotech, Cosmetics and consumer products, Food and agriculture.

Markets players: Rokit, Nuclera, Poietis, Vitro3D, Cell Applications, Inc., Prellis Biologics, Restor3d, Systemic Bio, Volumina Medical, Collplant, Organovo, Dimension INX, Vivita Technologies, Stratasys.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

RNA THERAPEUTICS – [29]

What is it? RNA therapeutics focuses on the development of treatments based on ribonucleic acid (RNA), a molecule that plays a crucial role in the regulation of gene expression and cellular processes. RNA-based therapies can be used to modulate the expression of disease-causing genes, providing a targeted and potentially more effective approach to treating a wide range of conditions.

Why is it important? RNA therapeutics offer a highly targeted approach to treating diseases by modulating the expression of specific genes, enabling personalized treatments based on a patient's genetic profile. RNA-based therapies can be used to address the root cause of genetic disorders by correcting or compensating for disease-causing mutations, offering the potential for disease modification or cure. RNA therapeutics can target a wide range of disease-causing genes and pathways that are difficult to address with traditional small molecule drugs or antibodies, expanding the range of druggable targets and treatment options.

What industries will it impact? Pharmaceutical and biotech, Genetic testing and diagnostics, Drug delivery and formulation, Healthcare.

Markets players: GSK, Ionis Pharmaceuticals, Stoke Therapeutics, PepGen, Arrowhead Pharmaceuticals, Sirnaomics, Evox therapeutics, Wave Life Sciences.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

NEUROMORPHIC COMPUTING – [30]

What is it? Neuromorphic computing is an emerging computing paradigm that takes inspiration from the structure and function of biological neural networks to design efficient and intelligent computing systems. It involves the development of artificial neural networks and specialized hardware architectures that mimic the way the human brain processes information. Neuromorphic systems are designed to emulate the highly parallel, distributed, and energy-efficient processing capabilities of biological brains, using artificial neurons and synapses as building blocks.

Why is it important? Neuromorphic computing has the potential to be highly energy-efficient compared to traditional computing architectures, as it processes information in a massively parallel and event-driven manner, similar to the human brain. Neuromorphic systems can process and respond to data in real-time, enabling fast and efficient decision-making in dynamic environments, such as autonomous vehicles or industrial control systems. The distributed and parallel nature of neuromorphic architectures makes them highly scalable and resistant to faults or failures, as the system can adapt and compensate for local disruptions or errors.

What industries will it impact? Artificial intelligence and machine learning, Robotics and autonomous systems, Edge computing and Internet of Things (IoT), Healthcare and biomedical devices, Aerospace and defense.

Markets players: IBM, Syntiant, Expedera, SynSense, Celestial AI, Aspinity, Lux Semiconductors, NOVI, Microsoft.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

CONDUCTIVE CARBON NANOMATERIALS – [31]

What is it? Conductive carbon materials exhibit high electrical conductivity due to their unique structural and electronic properties. These materials, which include graphene, carbon nanotubes, and carbon fibers are increasingly used as conductive additives in batteries.

Why is it important? Conductive carbon materials have high electron mobility and low electrical resistance, making them excellent conductors of electricity. Many conductive carbon materials, such as carbon fibers and graphene, have high strength-to-weight ratios, making them ideal for applications where lightweight and durable materials are required. Conductive carbon materials can be synthesized and processed in various forms, such as films, fibers, composites, and inks, allowing for their integration into a wide range of products and applications.

What industries will it impact? Electronics and semiconductors, Aerospace and automotive, Renewable energy, Additive manufacturing and 3D printing.

Markets players: Amprius Technologies, Inc., CAP-XX Limited, COnovate, EnWires, Graphene Manufacturing Group Pty Ltd, Lyten, NanoXplore, Nanotech Energy, Salvation Battery, Sino Applied Technology (SiAT), Sila Nanotechnologies, and Solidion Technology..

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

LIQUID METAL ALLOYS – [32]

What is it? Liquid metal alloys are materials that remain in a liquid state at room temperature, while exhibiting unique properties such as high thermal and electrical conductivity, low vapor pressure, and the ability to flow and deform in response to external stimuli. These materials, which include gallium, indium, and tin-based alloys, have gained interest for their potential applications in various fields.

Why is it important? Liquid metal alloys can be used to create flexible and stretchable electrical interconnects and components, enabling the development of wearable and implantable electronic devices. The high thermal conductivity of liquid metal alloys makes them attractive for use in thermal management applications, such as heat sinks, thermal interface materials, and cooling systems. The ability of liquid metal alloys to flow and deform allows for the creation of reconfigurable and adaptive systems, such as soft robots, shape-changing antennas, and tunable optical devices.

What industries will it impact? Electronics and semiconductors, Robotics and automation, Aerospace and defense, Biomedical and healthcare, Energy and power systems.

Markets players: Liquidmetal® Technologies, Inc., Ambri, Fluent Metal.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

ADVANCED CERAMICS – [33]

What is it? Advanced ceramics are high-performance materials that exhibit superior mechanical, thermal, and electrical properties compared to traditional ceramics. These materials, which include oxide and non-oxide ceramics, are engineered to withstand extreme conditions and provide enhanced functionality in a wide range of applications.

Why is it important? Advanced ceramics enable the development of high-performance components and systems that can operate in demanding conditions, such as high temperatures, corrosive environments, or under heavy loads. The unique thermal, electrical, and mechanical properties of advanced ceramics can help improve the efficiency of various energy conversion and storage systems, such as fuel cells, batteries, and solar cells. The use of advanced ceramics in critical components can significantly improve the durability and reliability of products, reducing maintenance requirements and extending service life.

What industries will it impact? Aerospace and defense, Automotive and transportation, Energy and power generation, Electronics and semiconductors, Medical and dental, Industrial manufacturing.

Markets players: Krahn Ceramics, SINTX Technologies, Bosch, Lithoz.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

MYCELIUM COMPOSITES – [34]

What is it? Mycelium composites are a class of bio-based materials that are made by growing fungal mycelium, the vegetative part of a fungus, on agricultural waste or other organic substrates. The resulting material is a lightweight, strong, and biodegradable composite that can be used as an alternative to traditional plastics and foams.

Why is it important? The use of mycelium composites can help reduce the environmental impact of various industries by replacing petroleum-based materials with biodegradable and renewable alternatives. Mycelium composites allow for the creation of sustainable and eco-friendly products, such as packaging materials, building insulation, and consumer goods, that align with growing consumer demand for environmentally responsible solutions. The production of mycelium composites can create new opportunities for local farmers and businesses, as agricultural waste can be used as a substrate for growing fungal mycelium.

What industries will it impact? Packaging and logistics, Construction and building materials, Automotive and transportation, Fashion and textiles, Consumer goods and electronics.

Markets players: Ecovative

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

SELF-HEALING MATERIALS – [35]

What is it? Self-healing materials are a class of advanced materials that have the ability to autonomously repair damage or degradation, restoring their original properties and extending their service life. These materials can respond to various stimuli, such as heat, light, or chemical signals, to initiate and complete the healing process.

Why is it important? Self-healing materials can significantly improve the durability and reliability of products and structures by autonomously repairing damage and preventing the propagation of cracks or other defects. The ability of self-healing materials to autonomously repair damage can reduce the need for manual maintenance and repair, lowering associated costs and downtime. Self-healing materials can help maintain the integrity and performance of critical components and structures, enhancing safety and resilience in various applications, from aerospace to biomedical implants.

What industries will it impact? Aerospace and defense, Automotive and transportation, Construction and infrastructure, Electronics and semiconductors, Biomedical and healthcare.

Markets players: A2O Advanced Materials Inc., Autonomic Materials, CompPair Technologies, Green Basilisk, Hyundai Motor Group, Mimicrete, NEI Corporation, Tandem Repeat.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

TRANSPARENT SOLAR PANELS – [36]

What is it? Transparent solar panels, also known as transparent photovoltaics (TPV), are a type of solar cell technology that allows for the creation of solar panels that are partially or fully transparent. These panels can be integrated into windows, skylights, or other glass surfaces, enabling the generation of clean electricity while maintaining optical transparency.

Why is it important? Transparent solar panels can help increase the adoption of renewable energy by enabling the integration of solar power generation into a wider range of surfaces and applications. The use of transparent solar panels in buildings can reduce reliance on grid electricity, lower energy costs, and contribute to the development of net-zero energy buildings. By generating clean electricity, transparent solar panels can help reduce the carbon footprint of buildings, vehicles, and other energy-consuming applications, contributing to global efforts to mitigate climate change.

What industries will it impact? Architecture and construction, Automotive and transportation, Consumer electronics and wearables, Agriculture and horticulture, Urban infrastructure and smart cities.

Markets players: Heliatek GmbH, UbiQD.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

CHEMICAL RECYCLING – [37]

What is it? Advanced chemical recycling, also known as feedstock recycling or tertiary recycling, is a set of technologies that break down plastic waste into its chemical constituents, allowing for the production of new plastics, chemicals, and fuels. Unlike traditional mechanical recycling, which has limitations in terms of the quality and applicability of recycled plastics, advanced chemical recycling can produce virgin-quality materials from a wider range of plastic waste streams.

Why is it important? Advanced chemical recycling can significantly increase the amount of plastic waste that can be recycled, helping to reduce plastic pollution and the environmental impact of plastic production. By displacing the need for virgin fossil feedstocks, advanced chemical recycling can help reduce greenhouse gas emissions associated with the production of plastics and chemicals. Advanced chemical recycling allows for the recovery and reuse of valuable chemical resources from plastic waste, improving resource efficiency and reducing the reliance on finite fossil resources.

What industries will it impact? Plastics and packaging, Chemical and petrochemical, Waste management and recycling, Consumer goods and retail.

Markets players: Agilyx, APK AG, Aquafil, Carbios, Eastman, Extracthive, Fych Technologies, Garbo, gr3n SA, Hyundai Chemical Ioniqa, RePEaT Co., Ltd., Synova, SABIC.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

PHOTONIC INTEGRATED CIRCUITS (PICS) – [38]

What is it? Photonic Integrated Circuits (PICs) are a type of integrated circuit that uses photons (light particles) instead of electrons to transmit and process information. PICs can transmit data at much higher speeds compared to traditional electronic circuits, as the speed of light is much faster than the movement of electrons. This makes them essential for high-bandwidth applications such as fiber-optic communication, high-speed internet, and data centers

Why is it important? PICs typically consume less power than their electronic counterparts, as they do not generate as much heat during operation. This makes them attractive for energy-efficient applications and portable devices. PICs can be fabricated using semiconductor manufacturing techniques, allowing for the integration of multiple photonic components on a single chip. This enables the development of compact and integrated photonic systems, reducing the size and weight of optical devices. Photonic signals are less susceptible to electromagnetic interference (EMI) and radio frequency interference (RFI) compared to electronic signals. This allows for the development of more robust and reliable systems, particularly in environments with high levels of electromagnetic noise.

What industries will it impact? Telecommunications, Data centers and cloud computing, Aerospace and defense, Healthcare, Quantum computing and information processing, Automotive and transportation, Consumer electronics.

Markets players: Intel, Lumentum, AEPONYX, Lumiphase, Lightmatter, Ranovus.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

CARBON REMOVAL CONCRETE – [39]

What is it? Carbon Removal Concrete is a type of concrete that is designed to actively remove and sequester carbon dioxide (CO2) from the atmosphere during its production and/or use.

Why is it important? The construction industry is a major contributor to global greenhouse gas emissions, responsible for approximately 40% of total emissions. Carbon Removal Concrete can assist by capturing and storing atmospheric CO2 within the concrete, reducing the overall carbon footprint of the industry. By incorporating captured CO2 into the concrete, Carbon Removal Concrete promotes a more circular economy, where waste and emissions are reused and repurposed, rather than being released into the environment. Carbon Removal Concrete aligns with the growing demand for sustainable and environmentally-friendly construction materials, contributing to the overall sustainability of the built environment. The carbon-capturing properties of Carbon Removal Concrete can enhance the durability and longevity of concrete structures, improving their resilience to environmental stresses and extending their lifespan.

What industries will it impact? Construction and Real Estate, Cement and Concrete Manufacturing, Carbon Capture and Storage (CCS) Industry, Engineering and Architecture, Waste Management and Recycling.

Markets players: CarbonCure, CarbiCrete, Carbon Clean, Neustark.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

EDIBLE COATINGS – [40]

What is it? Edible films and coatings will become an integral part of the fresh produce supply chain in the future as suppliers seek more sustainable solutions to extend product shelf-life, minimise food waste and deliver fresher fruits and vegetables to consumers. Edible films and coatings are made from edible biopolymers and food-grade additives.

Why is it important? Edible coatings can act as a protective barrier, preventing or slowing down the rate of physical, chemical, and microbiological deterioration of food products, thereby extending their shelf life. Edible coatings can help control the exchange of moisture, oxygen, carbon dioxide, and other gases between the food and the surrounding environment, preserving the food's quality and freshness. Edible coatings can be used to incorporate and deliver various nutrients, antioxidants, antimicrobial agents, and other beneficial compounds to the food, enhancing its nutritional and functional properties. Edible coatings can improve the visual appeal, texture, and overall sensory characteristics of food products, making them more attractive and desirable to consumers. Edible coatings can reduce the need for non-biodegradable packaging materials, contributing to more sustainable and environmentally-friendly food packaging solutions and reducing food waste.

What industries will it impact? Food and Beverage, Pharmaceutical and Nutraceutical, Agriculture and Horticulture, Packaging, Retail and e-Commerce.

Markets players: Apeel, DisSolves, FlexSea, FoodBerry, IUV Srl, Kuraray, mori, Notpla, Saveggy, Sun Chemical and Xampla.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

METAL-ORGANIC FRAMEWORKS (MOFS) – [41]

What is it? Metal-Organic Frameworks (MOFs) are a class of porous, crystalline materials composed of metal ions or clusters coordinated to organic linker molecules. They are an emerging class of materials with a wide range of potential applications.

Why is it important? MOFs can have exceptionally high surface areas, often exceeding 5,000 m^2/g, making them ideal for applications that require high-performance adsorption or catalysis. The structure and properties of MOFs can be tailored by selecting different metal ions and organic linkers, allowing for the design of materials with specific functionalities. MOFs can be engineered to have precisely controlled pore sizes and shapes, enabling selective adsorption, separation, and storage of target molecules or ions. MOFs can incorporate a wide range of active sites, such as catalytic centers, charge-transfer complexes, and encapsulated guest species, expanding their potential applications. Many MOFs are made from renewable and biodegradable organic components, contributing to their environmentally friendly and sustainable nature.

What industries will it impact? Energy, Environment, Gas Storage and Separation, Catalysis, Sensing and Diagnostics, Electronics and Optoelectronics, Biomedicine, Membranes and Separations.

Markets players: Atomis, BASF, Disruptive Materials AB, H2MOF, novoMOF AG, Nuada, NuMat Technologies, Inc., ProfMOF.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

BIO-BASED AND DEGRADABLE BATTERIES – [42]

What is it? Bio-based and degradable batteries are a new class of batteries that are designed to be environmentally friendly and sustainable. These batteries are made from biodegradable materials derived from renewable resources, such as plant-based materials or biomass, rather than traditional battery materials like lithium or lead.

Why is it important? Traditional batteries often contain toxic materials and heavy metals that can be harmful to the environment if not properly disposed of. Bio-based and degradable batteries are designed to be environmentally friendly and can degrade naturally, reducing the environmental impact of battery waste. These batteries rely on renewable and abundant resources, such as plant-based materials or waste biomass, rather than finite and non-renewable resources like lithium or cobalt. This helps to conserve natural resources and reduce dependence on mining and extraction activities. In the long run, bio-based and degradable batteries may offer cost savings compared to traditional batteries, as the raw materials used are generally more abundant and renewable. Researchers are exploring the use of different biomaterials and configurations for these batteries, which could lead to batteries with unique properties or applications.

What industries will it impact? Consumer electronics, Automotive industry, Energy storage, Medical devices, Internet of Things (IoT) and sensor networks.

Markets players: Stora Enso, X-Batt.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

SYNTHETIC BIOLOGY – [43]

What is it? Synthetic biology, also known as engineering biology, focuses on designing and applying biological processes to underpin new products and manufacturing approaches across a range of industries, from novel medicines and therapeutics to the sustainable production of food, energy, medicines, chemicals, and materials.

Why is it important? Synthetic biology enables the creation of new biological systems and organisms with tailored functions and capabilities, which can have applications in fields such as medicine, agriculture, environmental remediation, and industrial biotechnology. By redesigning existing biological systems or creating new ones, synthetic biology can lead to more efficient and optimized processes, such as the production of biofuels, pharmaceuticals, or other valuable compounds. Synthetic biology can contribute to the development of sustainable solutions by enabling the production of biobased materials, bioremediation of environmental pollutants, or the engineering of organisms for carbon capture and sequestration. Synthetic biology provides tools and approaches for studying and understanding the fundamental principles of life, gene regulation, and metabolic pathways, advancing our basic knowledge of biology.

What industries will it impact? Healthcare and pharmaceuticals, Agriculture and food production, Energy and biofuels, Environmental.

Markets players: Aanika Biosciences, Amyris, Apeel, Agrivida, Bolt Threads, Erebagen, Eligo Bioscience, Geltor, Ginkgo Bioworks, Impossible Foods, Industrial Microbes, Kiverdi, LanzaTech, Lygos, Mammoth Biosciences, Mango Materials, Perfect Day, Pivot Bio, Synthego, Twist Bioscience, Uluu, Van Heron Labs, and Viridos.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

GENERATIVE BIOLOGY – [44]

What is it? Generative biology combines principles from synthetic biology, computer science, and engineering to design and engineer biological systems using computational methods and automated workflows. It aims to streamline the process of designing, building, and testing new biological systems or modifying existing ones.

Why is it important? By leveraging computational tools and automation, generative biology can significantly speed up the process of designing and engineering biological systems, enabling faster exploration of potential solutions and applications. Generative biology allows for the design and construction of complex biological systems with multiple components and functionalities, which would be challenging or impossible to achieve through traditional manual methods. Computational models and simulations used in generative biology can provide insights into the behavior and performance of engineered biological systems, enabling more accurate predictions and optimizations. Automated workflows and computational tools used in generative biology can enhance the reproducibility and standardization of biological engineering processes, promoting consistency and reliability in research and applications.

What industries will it impact? Healthcare and pharmaceuticals, Agriculture and food production, Energy and biofuels, Environmental applications, Industrial biotechnology, Materials science.

Markets players: Absci, BigHat Biosciences, BioAge Labs, Bioptimus, Cradle, Deepcell, Evozyne, Generate:Biomedicines, Iambic Therapeutics, Insilico Medicine, Leash Biosciences, Model Medicines, Noetik, Profluent Bio, Terray Therapeutics, Xaira and Yoneda Labs.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

QUANTUM BATTERIES – [45]

What is it? Quantum batteries aim to exploit quantum phenomena, such as entanglement and coherence, to enhance the performance and efficiency of energy storage devices. Unlike classical batteries, quantum batteries have the potential to store and release energy in a fundamentally different way, leveraging the principles of quantum mechanics.

Why is it important? Quantum effects could potentially enable the storage of more energy in a given volume or weight compared to classical batteries, leading to higher energy densities and more compact energy storage solutions. Quantum batteries may allow for faster charging and discharging rates, facilitated by quantum phenomena such as coherent energy transfer or quantum tunneling. By exploiting quantum principles, quantum batteries could potentially operate with higher efficiencies, reducing energy losses during charging, discharging, and storage processes. The unique properties of quantum batteries could enable new applications or technologies that are not feasible with classical battery systems, such as ultra-low-power devices, quantum computing, or quantum sensing.

What industries will it impact? Electronics and consumer devices, Automotive and transportation, Renewable energy and grid storage, Aerospace and defense, Internet of Things (IoT).

Markets players: Planckian, IonQ, Quantinuum.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

AGRIVOLTAICS – [46]

What is it? Agrivoltaics, also known as solar sharing, is a system that combines agricultural activities with the generation of solar energy on the same land. It involves integrating solar photovoltaic (PV) panels with crops or livestock farming in a mutually beneficial way.

Why is it important? By combining solar energy production with agriculture, agrivoltaics allows for more efficient use of land resources, maximizing the productivity of a given area. In some cases, the partial shading provided by solar panels can benefit certain crops by reducing water evaporation, protecting plants from excessive heat, and creating a microclimate that can improve growth conditions. Agrivoltaics allows farmers to generate revenue from both agricultural produce and renewable energy production, providing an additional income stream and potentially increasing overall profitability. The combination of agriculture and solar energy can create synergistic benefits, such as using the solar panels for rainwater harvesting or utilizing the agricultural byproducts for on-site energy generation. Agrivoltaics promotes sustainable land use by combining renewable energy generation with food production, contributing to both energy security and food security.

What industries will it impact? Agriculture, Solar energy, Food production and security.

Markets players: Brite Solar, H2arvester, Insolight.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

WEARABLE ENERGY HARVESTING – [47]

What is it? Wearable energy harvesting refers to the process of capturing and converting ambient energy sources, such as body heat, motion, or light, into electrical energy to power wearable devices or sensors. This technology aims to provide a self-sustaining power source for wearable electronics, reducing or eliminating the need for traditional batteries.

Why is it important? By harnessing ambient energy, wearable energy harvesting systems can extend the battery life of wearable devices, reducing the need for frequent battery replacements or recharging. Eliminating the need for regular battery charging or replacement can enhance the user experience by providing a more seamless and convenient operation of wearable devices. Wearable energy harvesting can enable the development of new applications and devices that were previously impractical or impossible due to power constraints, such as continuous health monitoring or long-term environmental sensing. It also promotes sustainability by reducing the reliance on disposable batteries and the associated environmental impact of their production and disposal.

What industries will it impact? Healthcare and fitness, Consumer electronics, Military and defense, Industrial and occupational safety, Internet of Things (IoT) and smart homes, Environmental monitoring.

Markets players: Enervibe, Nexperia.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

PEROVSKITE MATERIALS – [48]

What is it? Perovskite materials are a class of crystalline compounds with a specific crystal structure, named after the mineral perovskite ($CaTiO_3$). These materials exhibit excellent optoelectronic properties, making them suitable for applications like LEDs, photodetectors, lasers, and optical sensors. The tunability of their bandgap allows for tailored optical properties, opening up opportunities in displays, lighting, and optical communication. Certain perovskite materials show promise for energy storage applications, such as batteries, supercapacitors, and fuel cells, as well as thermoelectric energy conversion.

Why is it important? Many perovskite materials exhibit excellent optoelectronic properties, such as high light absorption, long charge carrier diffusion lengths, and tunability of their bandgap. These properties make them promising for applications in solar cells, light-emitting diodes (LEDs), photodetectors, and lasers. Some perovskite materials possess ferroelectric and piezoelectric properties, which means they can generate an electric charge in response to mechanical stress or an electric field. These properties are valuable for applications in sensors, actuators, and energy harvesting devices. Perovskite materials can exhibit excellent catalytic activity for various chemical reactions, including oxidation, reduction, and photocatalysis, making them promising for applications in catalysis and environmental remediation.

What industries will it impact? Energy, Electronics and optoelectronics, Sensors and actuators, Catalysis and environmental remediation, Information and communication technologies, Healthcare.

Markets players: Saule Technologies, Microquanta Semiconductor, Swift Solar, Tokyo Chemical Industry.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

ANTIBODY-DRUG CONJUGATES (ADCS) – [49]

What is it? Antibody-drug conjugates (ADCs) are a class of targeted cancer therapeutics that combine the specificity of monoclonal antibodies with the potency of cytotoxic (cell-killing) drugs. ADCs are designed to selectively deliver these cytotoxic agents to cancer cells while minimizing exposure and damage to healthy cells.

Why is it important? ADCs leverage the ability of monoclonal antibodies to specifically recognize and bind to antigens expressed on the surface of cancer cells. This targeted approach allows for the delivery of the cytotoxic payload directly to the tumor site, potentially improving efficacy and reducing side effects compared to conventional chemotherapy. By selectively delivering the cytotoxic drug to cancer cells, ADCs can potentially increase the therapeutic index (the ratio of the maximum tolerated dose to the minimum effective dose) compared to traditional chemotherapeutic agents, which often lack specificity and can cause significant toxicity to healthy cells. ADCs offer a new approach to treating various types of cancers, including those that are resistant to conventional therapies or those with limited treatment options available. ADCs can be used in combination with other cancer therapies, such as chemotherapy, radiation, or immunotherapy, potentially enhancing the overall treatment efficacy.

What industries will it impact? Pharmaceutical and biotechnology, Oncology and cancer treatment, Antibody engineering and development, Drug delivery and targeting, Clinical research and trials.

Markets players: Adcendo, AdcentrX Therapeutics, Araris Biotech, AstraZeneca/Daiichi Sankyo, BioNTech/DualityBio, Bristol Myers Squibb, GSK, MBrace therapeutics, Pfizer/Seagen Roche, Takeda Pharmaceuticals.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

HEAT BATTERIES – [50]

What is it? Heat batteries, also known as thermal batteries or heat storage devices, are systems designed to store thermal energy for later use. These batteries operate by capturing and storing heat, which can then be released on demand to provide heating or generate electricity through a heat engine or thermophotovoltaic conversion.

Why is it important? Heat batteries offer a means of storing energy in the form of thermal energy, which can be used for heating, cooling, or electricity generation. This allows for the decoupling of energy production and consumption, enabling more efficient utilization of energy resources. Heat batteries can play a crucial role in integrating intermittent renewable energy sources, such as solar and wind power, into energy systems by storing excess thermal energy during periods of high production and releasing it when needed. They can capture and store waste heat from industrial processes, power plants, or other sources, allowing this otherwise wasted energy to be used for heating or electricity generation, improving overall energy efficiency. By storing heat during periods of low energy demand and releasing it when needed, heat batteries can help optimize energy systems, reducing peak demand and improving energy efficiency.

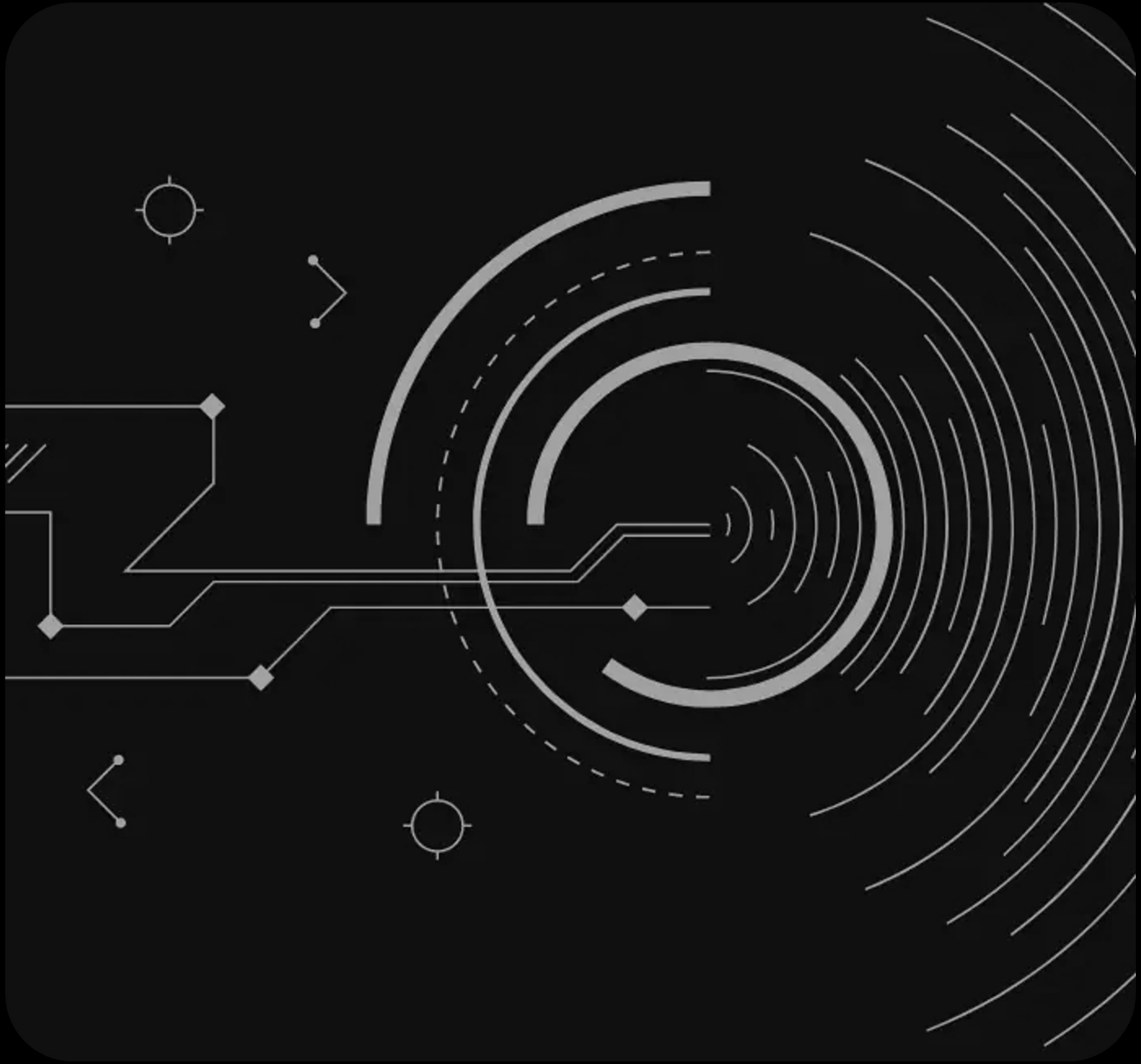
What industries will it impact? Energy and utilities, Industrial processes, Building and construction, Transportation, Concentrated solar power (CSP), Aerospace and defense.

Markets players: Rondo Energy, Sunamp.

https://www.futuremarketsinc.com/techvision-50-fifty-emerging-technologies-and-materials-that-will-shape-the-future/

FYND ACADEMY

Top 30 Emerging Technologies



https://www.fynd.academy/blog/latest-technologies

FYND ACADEMY

TOP 30 EMERGING TECHNOLOGIES

1. Artificial Intelligence (AI)
2. Machine Learning (ML)
3. Quantum Computing
4. 5G Networks
5. Blockchain
6. Internet of Things (IoT)
7. Augmented Reality (AR)
8. Virtual Reality (VR)
9. Edge Computing
10. Autonomous Vehicles
11. Robotics
12. Biotechnology
13. Genetic Engineering
14. Cloud Computing
15. Nanotechnology
16. Drones
17. Digital Twins
18. Smart Cities
19. Cybersecurity Advancements
20. Wearable Technology
21. Predictive Analytics
22. Natural Language Processing (NLP)
23. Cryptocurrency
24. Renewable Energy Tech
25. Voice Assistants
26. Smart Manufacturing
27. 3D Printing
28. Smart Healthcare Solutions
29. Chatbots
30. AI-powered Cyber Defense Systems

https://www.fynd.academy/blog/latest-technologies

ARTIFICIAL INTELLIGENCE (AI) – [1]

Short Description

Artificial Intelligence (AI) involves creating systems that can perform tasks that would typically require human intelligence, such as learning, reasoning, and problem-solving. This field encompasses various sub-disciplines, including machine learning, natural language processing, and robotics. AI is revolutionizing industries across the globe by improving efficiencies, enhancing user experiences, and enabling new capabilities that were previously unimaginable. In healthcare, AI algorithms are used to diagnose diseases, predict patient outcomes, and personalize treatment. Machine learning models can sift through large datasets of medical information to identify patterns that may go unnoticed by human doctors, resulting in faster and more accurate diagnoses. In business, AI powers recommendation engines, chatbots, and virtual assistants, which have become integral in customer service and marketing automation.

The potential applications of AI are vast, with continuous advancements driving even more impressive innovations. AI has also become a key enabler in the development of autonomous systems, such as self-driving cars and drones. AI is central to the development of these technologies because it allows machines to learn from data, adapt to new environments, and make decisions in real time. The future of AI promises even greater advances, particularly in the areas of general AI, where systems will have the ability to reason and think like humans. As AI continues to evolve, its ability to perform complex tasks, understand natural language, and interact with humans will open up new possibilities in areas like education, entertainment, and transportation.

https://www.fynd.academy/blog/latest-technologies

MACHINE LEARNING (ML) – [2]

Short Description

Machine Learning (ML) is a subset of AI that allows computers to learn from and make decisions based on data without explicit programming. ML algorithms identify patterns in large datasets, and through these patterns, they generate insights, predictions, and recommendations. A variety of ML techniques, such as supervised learning, unsupervised learning, and reinforcement learning, enable systems to analyze data, understand relationships, and improve over time with experience. In industries like finance, ML is used for fraud detection, where algorithms continuously analyze transactions to spot unusual activity. Similarly, in retail, ML powers recommendation engines that suggest products based on customer behavior, preferences, and historical data.

As the volume of data produced grows exponentially, machine learning becomes increasingly important. The ability of ML systems to process vast amounts of data and adapt to changes has transformed industries from healthcare to entertainment. In the healthcare sector, ML algorithms analyze medical images to assist in diagnosing diseases like cancer and heart conditions. Additionally, ML is crucial in natural language processing (NLP) applications such as speech recognition and sentiment analysis. The future of ML holds even more promise, with the potential to revolutionize areas like autonomous vehicles, personalized medicine, and predictive analytics, where systems can not only learn from data but anticipate future trends and behaviors.

https://www.fynd.academy/blog/latest-technologies

QUANTUM COMPUTING – [3]

Short Description

Quantum computing leverages the principles of quantum mechanics to process information in fundamentally new ways, allowing for exponential increases in computational power. Unlike classical computers, which use bits to represent data in a binary state (0 or 1), quantum computers use qubits, which can exist in multiple states simultaneously due to superposition. This ability allows quantum computers to solve certain complex problems much faster than traditional computers. Quantum computing has the potential to revolutionize fields such as cryptography, materials science, and artificial intelligence by handling problems that classical computers cannot efficiently solve. For example, in cryptography, quantum computing could break current encryption methods, but it could also enable the creation of new, more secure encryption techniques that are resistant to quantum attacks.

While quantum computing is still in the early stages of development, its potential to change industries is immense. In pharmaceuticals, quantum computers could simulate molecular structures, speeding up drug discovery and making it possible to develop personalized treatments based on individual genetic profiles. In finance, quantum algorithms could optimize complex portfolios and risk models much faster than traditional methods. Additionally, quantum computing could assist in solving large-scale optimization problems, such as determining the most efficient routes for logistics or reducing energy consumption in industries. As quantum computing advances, its applications will grow, potentially solving problems that are currently considered intractable and reshaping industries across the globe.

https://www.fynd.academy/blog/latest-technologies

5G NETWORKS – [4]

Short Description

5G is the fifth generation of mobile network technology, offering significant improvements in speed, connectivity, and reliability over its predecessor, 4G. With 5G, users can experience download speeds up to 100 times faster, allowing for faster streaming, quicker data transfer, and more efficient internet access. This technology is not just about faster speeds; it also reduces latency, enabling near-instantaneous communication between devices. The ultra-low latency of 5G is particularly beneficial for applications that require real-time interactions, such as remote surgeries, autonomous vehicles, and gaming. In the healthcare sector, 5G's low latency enables doctors to perform surgeries remotely, using robotics controlled in real-time, regardless of location.

Moreover, 5G will play a key role in the development of the Internet of Things (IoT), as it will be capable of supporting a massive number of connected devices simultaneously. Smart cities, for example, will benefit from 5G by enabling efficient management of urban infrastructure, such as traffic, waste, and energy use. The ability to transmit data faster and more reliably will also allow for advancements in sectors like manufacturing, agriculture, and education. As more IoT devices come online, 5G will provide the necessary network capabilities to handle the increased data flow, leading to smarter, more connected environments. The full rollout of 5G will not only transform mobile connectivity but also create new opportunities for businesses and consumers alike.

https://www.fynd.academy/blog/latest-technologies

BLOCKCHAIN – [5]

Short Description

Blockchain is a decentralized and distributed ledger technology that allows transactions to be securely recorded and verified across a network of computers. Initially popularized by Bitcoin, blockchain has since found applications in various industries, including finance, healthcare, and supply chain management. One of the key benefits of blockchain is its ability to provide transparency and immutability. Each transaction is recorded in a "block," and once added to the chain, it cannot be altered or deleted, ensuring that records are tamper-proof. This makes blockchain an attractive solution for industries where data integrity and security are paramount, such as banking and healthcare. Blockchain also eliminates the need for intermediaries, reducing transaction costs and improving efficiency.

In addition to its use in cryptocurrencies, blockchain is being explored for various applications, such as smart contracts, voting systems, and identity management. Smart contracts are self-executing contracts in which the terms of the agreement are directly written into code. This removes the need for intermediaries and ensures that contracts are executed automatically when the predefined conditions are met. In supply chain management, blockchain provides a transparent, auditable record of the movement of goods, allowing businesses to track products from origin to destination. Furthermore, blockchain's ability to enhance cybersecurity by ensuring data integrity and preventing unauthorized access has led to its adoption in industries like insurance, legal services, and real estate.

https://www.fynd.academy/blog/latest-technologies

INTERNET OF THINGS (IOT) – [6]

Short Description

The Internet of Things (IoT) refers to the interconnected network of physical devices that communicate and exchange data with one another through the Internet. These devices range from everyday household items like refrigerators and thermostats to complex industrial machinery and wearable health devices. By embedding sensors and software into objects, IoT allows them to collect and share data, creating smart environments that can adapt to human needs and automate tasks. For example, in homes, IoT devices such as smart thermostats adjust temperatures based on user behavior and environmental factors, optimizing energy use and enhancing comfort.

In industries, IoT has the potential to transform operations by enabling predictive maintenance, improving supply chain management, and enhancing safety. For example, IoT sensors in manufacturing equipment can monitor machine performance and predict failures before they happen, reducing downtime and maintenance costs. In agriculture, IoT devices can monitor soil moisture and temperature, helping farmers optimize irrigation and crop management. As IoT continues to expand, it will create more efficient, data-driven environments, fostering smarter cities, industries, and homes while improving quality of life.

https://www.fynd.academy/blog/latest-technologies

AUGMENTED REALITY (AR) – [7]

Short Description

Augmented Reality (AR) enhances the real-world environment by overlaying digital information such as images, sounds, and text onto it in real time. AR technology can be experienced through devices like smartphones, tablets, and specialized glasses, offering immersive interactions with the environment. One of the most prominent applications of AR is in retail, where consumers can visualize products in their homes before making a purchase, such as seeing how a piece of furniture fits into their living room. In education, AR enables interactive learning experiences by allowing students to engage with 3D models of objects or historical events, enhancing understanding through visual representation.

In healthcare, AR has been used in surgical procedures to provide real-time data and imagery, improving precision during operations. AR is also used for remote assistance in industries like maintenance and repair, where experts can guide workers by providing step-by-step instructions overlaid in the real-world environment. The potential for AR in gaming, marketing, and tourism is equally significant, offering new ways for users to interact with their surroundings. As AR technology advances, its applications are expected to become even more widespread, offering innovative ways to interact with both the physical and digital worlds.

https://www.fynd.academy/blog/latest-technologies

VIRTUAL REALITY (VR) – [8]

Short Description

Virtual Reality (VR) immerses users in a completely digital environment that can simulate real-world scenarios or create entirely fantastical experiences. Using VR headsets, users are transported into environments where they can interact with objects and surroundings, often using controllers or haptic feedback devices. VR has gained traction in gaming, offering immersive experiences where players can explore vast virtual worlds and engage in interactive gameplay. It also has significant potential in training and simulation, where professionals in fields like aviation, medicine, and the military can practice real-world scenarios in a controlled, risk-free virtual setting.

For example, VR is used to simulate surgeries, enabling medical students to perform operations without the risk of harming patients. In entertainment, VR is providing new ways for users to experience movies, concerts, and live events, offering fully immersive, 360-degree environments. Additionally, VR is being explored for its use in remote work and collaboration, allowing teams to meet in virtual offices and interact with 3D models, even if they are located in different parts of the world. As technology evolves, VR is expected to have a profound impact on sectors such as education, healthcare, and real estate, making it easier to engage in interactive learning, visualize projects, and conduct virtual meetings.

https://www.fynd.academy/blog/latest-technologies

EDGE COMPUTING – [9]

Short Description

Edge Computing is a decentralized form of computing where data processing occurs closer to the data source or "edge" of the network rather than in a centralized cloud-based data center. This reduces latency, improves speed, and optimizes bandwidth usage, making it particularly valuable for applications that require real-time processing. Edge computing is commonly used in Internet of Things (IoT) devices, autonomous vehicles, and industrial automation systems, where immediate data processing is crucial for functionality. For instance, self-driving cars rely on edge computing to process sensor data from their surroundings in real time, enabling them to make split-second decisions.

By processing data locally, edge computing reduces the load on cloud servers and minimizes the risks associated with transmitting sensitive data over the internet. This makes it more secure and efficient, particularly for industries like healthcare, where data privacy and speed are critical. Edge computing is also enhancing smart city technologies, such as traffic management systems, where real-time data analysis is required to optimize traffic flow and improve safety. As more devices become interconnected, edge computing will play a crucial role in handling the vast amounts of data generated by IoT and enabling faster, more efficient decision-making.

https://www.fynd.academy/blog/latest-technologies

AUTONOMOUS VEHICLES – [10]

Short Description

Autonomous vehicles (AVs) are self-driving cars that use a combination of sensors, cameras, machine learning, and artificial intelligence to navigate and operate without human intervention. These vehicles are designed to detect their surroundings, make real-time decisions, and ensure safe travel on roads. The technology behind autonomous vehicles includes sophisticated systems for obstacle detection, route planning, and decision-making, which work together to enable safe navigation. AVs have the potential to reduce traffic accidents caused by human error, improve traffic flow, and revolutionize transportation networks. For example, autonomous vehicles could enable more efficient public transit systems, where vehicles travel in coordinated fleets to reduce congestion and energy consumption.

Beyond personal vehicles, autonomous technology is also being developed for trucks, which could transform the logistics industry. Autonomous trucks can drive long distances without the need for human drivers, improving delivery times and reducing transportation costs. Additionally, AVs are poised to provide mobility solutions for elderly or disabled individuals, offering greater independence and access to transportation. While fully autonomous vehicles are still being tested and refined, the ongoing development of AV technology is expected to significantly impact the transportation industry, creating safer, more efficient, and sustainable systems in the future.

https://www.fynd.academy/blog/latest-technologies

ROBOTICS – [11]

Short Description

Robotics involves the design and creation of robots that can perform tasks autonomously or with minimal human intervention. Robots have become increasingly sophisticated, with applications ranging from industrial manufacturing to healthcare and service industries. In manufacturing, robots are used for tasks like assembly, welding, and packaging, often in environments that are hazardous to humans or where precision is required. These robots can work continuously, improving efficiency and reducing the potential for human error. In healthcare, surgical robots allow for minimally invasive procedures, offering greater precision and quicker recovery times for patients.

Beyond industrial and healthcare applications, robotics is also transforming industries like logistics, agriculture, and customer service. Robots are being used in warehouses to automate inventory management, sorting, and packaging processes. In agriculture, autonomous robots can plant, monitor, and harvest crops, increasing yield and reducing the need for labor. The rise of humanoid robots in customer service is providing businesses with cost-effective solutions for engaging customers and improving the customer experience. As robotics technology advances, it holds the potential to create entirely new industries and job opportunities while enhancing productivity across various sectors.

https://www.fynd.academy/blog/latest-technologies

BIOTECHNOLOGY – [12]

Short Description

Biotechnology refers to the use of biological systems, organisms, or derivatives to develop products and processes for various applications, including healthcare, agriculture, and environmental protection. It leverages the power of living organisms to improve human health and the quality of life. In medicine, biotechnology is at the forefront of developing new therapies, such as gene therapies and biological drugs, which can treat diseases at a genetic or molecular level. It is also pivotal in creating vaccines and advancing personalized medicine, where treatments are tailored to individual genetic profiles.

In agriculture, biotechnology is helping to create genetically modified crops that are more resistant to pests, diseases, and environmental stress, which can lead to increased food security and reduced use of harmful pesticides. Biotech advancements also play a role in environmental sustainability, such as the development of biofuels and other renewable energy sources. The potential for biotechnology to revolutionize healthcare, agriculture, and environmental conservation continues to grow, with innovations that can address pressing global challenges like climate change, hunger, and disease.

https://www.fynd.academy/blog/latest-technologies

GENETIC ENGINEERING – [13]

Short Description

Genetic Engineering involves modifying the genetic makeup of an organism to achieve desired traits. This field of science enables the alteration of DNA to improve organisms in ways that were not possible through traditional breeding or natural selection. Genetic engineering has significant applications in medicine, agriculture, and environmental conservation. In medicine, it is used to develop gene therapies for genetic disorders, create genetically modified organisms (GMOs) for drug production, and produce vaccines that can prevent diseases like hepatitis and influenza.

In agriculture, genetic engineering is used to create crops that are more resilient to environmental stress, pests, and diseases. Crops such as Bt corn, which produces its insecticide, have been engineered to improve yield and reduce pesticide use. In the future, genetic engineering could also be used to address food security issues by creating crops that are drought-resistant or more nutritious. While genetic engineering holds tremendous promise, it also raises ethical and ecological concerns, especially around GMOs and their potential impacts on biodiversity.

https://www.fynd.academy/blog/latest-technologies

CLOUD COMPUTING – [14]

Short Description

Cloud Computing refers to the delivery of computing services such as servers, storage, databases, networking, software, and analytics over the Internet. This allows businesses and individuals to access and use technology resources without having to own or maintain physical infrastructure. Cloud computing provides scalable and on-demand access to computing power, making it easier and more cost-effective for organizations to scale their operations and manage data. Major cloud service providers like Amazon Web Services (AWS), Microsoft Azure, and Google Cloud offer a range of solutions for data storage, virtual machines, machine learning, and more.

One of the biggest advantages of cloud computing is its flexibility and efficiency. Organizations can quickly scale their resources based on demand and only pay for what they use, reducing operational costs. Cloud platforms also enhance collaboration by enabling remote work and real-time access to shared files and applications. The rapid adoption of cloud computing has revolutionized industries across the globe, from e-commerce and finance to healthcare and education, offering new opportunities for innovation and business growth.

https://www.fynd.academy/blog/latest-technologies

NANOTECHNOLOGY – [15]

Short Description

Nanotechnology is the science, engineering, and application of materials and devices at the nanoscale, typically at the scale of one to 100 nanometers. This technology enables the manipulation of atoms and molecules to create materials and devices with enhanced properties, such as increased strength, improved conductivity, or greater chemical reactivity. Nanotechnology is making significant strides in fields such as medicine, electronics, and materials science. In medicine, it is being used to develop targeted drug delivery systems, where nanoparticles carry medication directly to the site of disease, reducing side effects and increasing treatment efficacy.

In electronics, nanotechnology has enabled the development of smaller, faster, and more efficient devices, such as high-performance semiconductors and advanced sensors. The potential for nanotechnology to create breakthrough innovations in energy storage, water filtration, and even space exploration is enormous. Despite its promise, the widespread use of nanotechnology also raises concerns about environmental impact and the long-term safety of nanoscale materials, requiring careful regulation and research into potential risks.

https://www.fynd.academy/blog/latest-technologies

DRONES – [16]

Short Description

Drones, or uncrewed aerial vehicles (UAVs), are aircraft that operate without a pilot on board and can be controlled remotely or autonomously. Drones are becoming increasingly popular in a variety of industries, from agriculture and logistics to filmmaking and surveillance. In agriculture, drones are used for crop monitoring, soil analysis, and spraying pesticides or fertilizers. In logistics, drones are being explored as a means to deliver small packages quickly and efficiently, reducing delivery times and operational costs. Drone technology is also being integrated into disaster response systems, where drones can access areas that are dangerous or difficult for humans to reach.

In the military and defense sectors, drones have been widely used for surveillance, reconnaissance, and even combat missions. Drones are also transforming the way we think about infrastructure inspection and maintenance. They can be used to inspect bridges, power lines, and pipelines, providing real-time data and imagery that can help identify problems before they become serious. As drone technology evolves, new applications will emerge, offering opportunities for innovation across industries.

https://www.fynd.academy/blog/latest-technologies

DIGITAL TWINS – [17]

Short Description

A Digital Twin is a virtual replica of a physical object, system, or process that allows real-time monitoring, analysis, and simulation. This technology has applications across a wide range of industries, including manufacturing, healthcare, and urban planning. In manufacturing, digital twins can simulate the performance of machinery or entire production lines, allowing companies to predict failures, optimize efficiency, and reduce downtime. In the energy sector, digital twins can model the behavior of power plants, helping to predict energy demand and improve system efficiency.

In urban planning, digital twins are used to create virtual models of cities, enabling better decision-making when it comes to infrastructure development, traffic management, and environmental sustainability. Digital twins are also making their mark in healthcare, where they are used to create digital replicas of patients' bodies, enabling doctors to simulate and test treatments before applying them. As the technology matures, digital twins will play an even more integral role in improving operational efficiencies, reducing costs, and enabling more sustainable practices.

https://www.fynd.academy/blog/latest-technologies

SMART CITIES – [18]

Short Description

Smart cities use digital technologies to improve the quality of life for residents, enhance sustainability, and optimize the efficiency of urban services. These cities incorporate IoT sensors, data analytics, and AI to manage everything from traffic flow and energy consumption to waste management and water distribution. For example, smart traffic systems can analyze real-time traffic data to adjust traffic lights, reducing congestion and improving mobility. Similarly, smart grids optimize electricity use, helping cities reduce energy consumption and minimize costs.

In addition to improving operational efficiency, smart cities aim to make urban environments more livable and sustainable. For instance, smart buildings equipped with IoT sensors can monitor temperature, humidity, and air quality, ensuring a comfortable and healthy environment for occupants. These technologies also help cities tackle environmental challenges, such as air pollution and water scarcity, by providing real-time data and enabling proactive interventions. The widespread implementation of smart city technologies is expected to make urban living more sustainable, efficient, and connected, offering significant benefits to citizens and local governments.

https://www.fynd.academy/blog/latest-technologies

CYBERSECURITY ADVANCEMENTS – [19]

Short Description

Cybersecurity advancements are crucial in protecting data, systems, and networks from ever-evolving threats, including cyberattacks, data breaches, and ransomware. As organizations continue to digitize and move operations to the cloud, the need for robust cybersecurity measures has never been greater. Emerging technologies, such as AI and machine learning, are being used to detect and respond to threats in real time, automating the identification of vulnerabilities and malicious activities. These advancements help security teams address security incidents before they escalate, minimizing damage and data loss.

One of the key trends in cybersecurity is the adoption of zero-trust security models, which require users to verify their identity and the security of devices before accessing networks, regardless of whether they are inside or outside the network perimeter. Blockchain technology is also being used to enhance security by creating immutable, transparent records of transactions, reducing the risk of data tampering and fraud. As cyber threats grow more sophisticated, the integration of advanced technologies like AI, blockchain, and encryption will play a crucial role in safeguarding sensitive information and maintaining trust in digital systems.

https://www.fynd.academy/blog/latest-technologies

WEARABLE TECHNOLOGY – [20]

Short Description

Wearable technology refers to electronic devices designed to be worn on the body, providing continuous connectivity, data collection, and user interaction. These devices can track physical activity, monitor health metrics like heart rate and blood oxygen levels, and even provide real-time notifications. The most common example of wearable technology is fitness trackers, such as Fitbit and Apple Watch, which help users monitor their exercise habits, sleep patterns, and overall health. In healthcare, wearable devices can track chronic conditions like diabetes and help patients manage their treatment plans.

Wearable technology is also being integrated into industries such as entertainment and fashion, where smart glasses, headsets, and clothing with built-in sensors are enhancing user experiences. For example, augmented reality glasses can provide real-time information overlaid on the user's field of vision, creating new opportunities for gaming, navigation, and education. As wearable technology becomes more sophisticated, it has the potential to improve healthcare outcomes, enhance productivity in the workplace, and transform industries that rely on constant, real-time data.

https://www.fynd.academy/blog/latest-technologies

PREDICTIVE ANALYTICS – [21]

Short Description

Predictive analytics uses statistical algorithms, machine learning, and data mining techniques to analyze historical data and predict future outcomes. This technology helps businesses anticipate trends, make informed decisions, and optimize operations. In sectors like finance, predictive analytics is used to forecast stock market trends and assess credit risk, while in healthcare, it can predict disease outbreaks or patient outcomes, leading to more proactive care. It can also help companies forecast customer demand, enabling better inventory management and reducing costs.

Beyond business applications, predictive analytics is transforming industries like transportation, where it predicts traffic patterns to improve route planning or agriculture, where it forecasts crop yields based on weather data. As more industries adopt predictive analytics, it is playing a crucial role in improving efficiency, reducing risks, and providing valuable insights that would have been difficult to uncover using traditional methods. This technology's capacity to provide actionable insights from big data is poised to revolutionize how organizations plan, operate, and strategize for the future.

https://www.fynd.academy/blog/latest-technologies

NATURAL LANGUAGE PROCESSING (NLP) – [22]

Short Description

Natural Language Processing (NLP) is a branch of artificial intelligence that focuses on enabling machines to understand, interpret, and respond to human language. It involves teaching computers to process and analyze vast amounts of natural language data, such as text and speech, and to make sense of it in a meaningful way. NLP is used in applications such as speech recognition, sentiment analysis, chatbots, and machine translation. For example, virtual assistants like Siri and Alexa rely on NLP to understand spoken commands and provide relevant responses.

One of the major challenges of NLP is ensuring that machines can understand the nuances of human language, including context, tone, and intent. However, recent advancements in deep learning and neural networks have significantly improved the accuracy of NLP systems. As NLP technology matures, it is expected to enhance communication between humans and machines, offering personalized customer service, improving accessibility for people with disabilities, and facilitating real-time language translation across the globe. Its integration into industries such as healthcare, law, and customer service is already transforming workflows and efficiency.

https://www.fynd.academy/blog/latest-technologies

CRYPTOCURRENCY – [23]

Short Description

Cryptocurrency is a digital or virtual currency that uses cryptography for security and operates independently of a central authority, such as a bank or government. The most well-known cryptocurrency, Bitcoin, was created in 2009 as a decentralized alternative to traditional currencies. Since then, thousands of cryptocurrencies have been developed, each with its features, uses, and underlying technology. The blockchain technology that underpins cryptocurrencies provides a transparent and immutable ledger of transactions, making them secure and tamper-proof.

Cryptocurrencies are revolutionizing the financial sector by enabling peer-to-peer transactions without intermediaries, lowering transaction costs, and increasing financial inclusion, particularly in regions with limited access to traditional banking services. However, cryptocurrencies have also raised concerns about volatility, regulatory challenges, and potential misuse for illegal activities. Despite these concerns, their growing acceptance by businesses, governments, and consumers indicates that cryptocurrency will continue to play a significant role in the future of finance, particularly in decentralized finance (DeFi) and cross-border payments.

https://www.fynd.academy/blog/latest-technologies

RENEWABLE ENERGY TECH – [24]

Short Description

Renewable energy technology encompasses a range of innovations designed to harness natural resources, such as sunlight, wind, and water, to generate clean and sustainable energy. Solar power, wind energy, and hydroelectricity are the most common forms of renewable energy, but new technologies, such as tidal energy, geothermal power, and bioenergy, are gaining traction. Advances in energy storage, such as improved battery technology, are also enabling more efficient use of renewable energy by addressing the intermittent nature of sources like solar and wind.

The shift towards renewable energy is crucial for reducing carbon emissions, combating climate change, and achieving energy independence. As renewable energy technologies become more cost-effective and scalable, they are expected to replace traditional fossil fuels and form the backbone of a sustainable global energy system. The adoption of clean energy solutions is also driving the development of electric vehicles (EVs) and smart grids, further accelerating the transition to a low-carbon economy and promoting environmental sustainability.

https://www.fynd.academy/blog/latest-technologies

VOICE ASSISTANTS – [25]

Short Description

Voice assistants are AI-powered technologies that allow users to interact with devices and services through voice commands. Popular voice assistants like Amazon's Alexa, Apple's Siri, and Google Assistant can perform tasks such as setting reminders, playing music, controlling smart home devices, and answering questions. These assistants use natural language processing (NLP) to understand spoken words and provide appropriate responses. Over time, voice assistants have become more sophisticated, offering better accuracy, context awareness, and the ability to handle a wider range of tasks.

Voice assistants are transforming how people interact with technology, making it more hands-free, efficient, and accessible. In homes, they are central to smart home ecosystems, controlling lights, thermostats, and appliances. In business, voice assistants are helping improve customer service by providing automated responses to common inquiries, improving efficiency, and reducing the need for human intervention. As voice recognition technology continues to improve, voice assistants will become even more integrated into daily life, with applications across industries like healthcare, retail, and entertainment, making tasks easier and more convenient for users.

https://www.fynd.academy/blog/latest-technologies

SMART MANUFACTURING – [26]

Short Description

Smart manufacturing involves the integration of advanced technologies, such as IoT, AI, robotics, and big data analytics, to optimize manufacturing processes and improve efficiency. By connecting machines, sensors, and devices within a factory, smart manufacturing enables real-time monitoring and data analysis to improve productivity, reduce downtime, and optimize resource allocation. Predictive maintenance, for instance, can anticipate equipment failures before they occur, minimizing unplanned downtime and increasing operational efficiency.

In addition to enhancing productivity, smart manufacturing is driving sustainability by reducing waste, energy consumption, and emissions. Advanced robotics and automation also contribute to a safer working environment by handling hazardous tasks and reducing the risk of human injury. The widespread adoption of smart manufacturing is revolutionizing industries such as automotive, aerospace, and electronics, enabling mass customization, shorter production cycles, and greater flexibility in meeting consumer demand. As technology evolves, smart manufacturing will continue to push the boundaries of what is possible in industrial production.

https://www.fynd.academy/blog/latest-technologies

3D PRINTING – [27]

Short Description

3D printing, also known as additive manufacturing, is a process of creating three-dimensional objects by layering material based on a digital model. This technology has gained popularity in industries like aerospace, healthcare, automotive, and consumer goods due to its ability to create complex, customized, and cost-effective products with high precision. In healthcare, 3D printing is used to create prosthetics, implants, and even organs, revolutionizing personalized medicine. In manufacturing, it allows for rapid prototyping, reducing time to market and costs associated with traditional manufacturing processes.

3D printing has the potential to transform supply chains by enabling localized, on-demand production of parts and products. This reduces the need for mass production and long-distance shipping, leading to more sustainable manufacturing practices. As material science advances, 3D printing is expected to expand its applications to include more diverse materials, from metals to biodegradable plastics, offering new possibilities for innovation. Its impact on industries ranging from construction to food production could be profound, changing the way products are designed, manufactured, and distributed.

https://www.fynd.academy/blog/latest-technologies

SMART HEALTHCARE SOLUTIONS – [28]

Short Description

Smart healthcare solutions leverage technology to enhance the quality, efficiency, and accessibility of healthcare services. These solutions include wearable devices that monitor patients' vital signs, telemedicine platforms that enable remote consultations, and AI-powered diagnostic tools that analyze medical data to assist doctors in making accurate decisions. In addition to improving patient care, smart healthcare solutions help reduce healthcare costs, enhance treatment outcomes, and enable personalized medicine by using real-time data to tailor treatments to individual patients.

Smart healthcare solutions are also transforming hospital management and administrative tasks, reducing errors, streamlining workflows, and improving the patient experience. For example, AI-based systems can analyze medical records to predict patient needs, manage hospital resources efficiently, and improve patient flow. In the future, as healthcare becomes more data-driven, the integration of IoT, AI, and big data analytics will further revolutionize the industry, allowing for better preventive care, faster diagnoses, and more effective treatments.

https://www.fynd.academy/blog/latest-technologies

CHATBOTS – [29]

Short Description

Chatbots are AI-powered software applications that simulate human conversation, providing automated customer support and engagement. They use natural language processing (NLP) and machine learning to understand and respond to user inquiries in real time, available 24/7. Chatbots are widely used in customer service, where they can handle frequently asked questions, process orders, assist with troubleshooting, and provide personalized recommendations. This reduces the need for human intervention, improving efficiency and customer satisfaction.

In addition to customer service, chatbots are also being utilized in areas like sales, marketing, and even healthcare. For example, healthcare chatbots can help patients schedule appointments, provide medication reminders, and answer common medical questions, improving accessibility to care. As AI and NLP technologies continue to evolve, chatbots will become even more sophisticated, capable of handling more complex interactions and providing personalized experiences, making them an integral part of business operations across industries.

https://www.fynd.academy/blog/latest-technologies

AI-POWERED CYBER DEFENSE SYSTEMS – [30]

Short Description

AI-powered cyber defense systems utilize machine learning, big data analytics, and pattern recognition to detect, prevent, and respond to cyber threats in real time. These systems can automatically identify unusual network activity, flag potential vulnerabilities, and block malicious activities before they cause significant damage. By analyzing large volumes of data and learning from historical attack patterns, AI-based systems can identify new, previously unknown threats, enhancing cybersecurity measures far beyond traditional methods.

AI-powered cyber defense systems are increasingly crucial as cyberattacks become more sophisticated and frequent. They help organizations stay ahead of evolving threats by providing proactive protection rather than reactive measures. In industries such as finance, healthcare, and government, where sensitive data is constantly at risk, these systems are essential for maintaining security and trust. As the landscape of cybersecurity continues to evolve, AI-powered solutions will play a key role in safeguarding critical infrastructure and sensitive information from emerging cyber threats.

https://www.fynd.academy/blog/latest-technologies

SSBM GENEVA

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

Top 25 Emerging Technology Trends to Watch in 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

SSBM GENEVA

TOP 25 EMERGING TECHNOLOGY TRENDS TO WATCH IN 2025

1. Generative AI
2. Quantum Computing
3. 5G Expansion
4. Virtual Reality (VR) 2.0
5. Augmented Reality (AR)
6. Internet of Things (IoT) in Smart Cities
7. Biotechnology in Agriculture
8. Autonomous Vehicles
9. Blockchain Beyond Cryptocurrency
10. Edge Computing
11. Personalized Medicine
12. Neuromorphic Computing
13. Green Energy Technologies
14. Wearable Health Monitors
15. Extended Reality (XR) for Training
16. Voice-Activated Technology
17. Space Tourism
18. Synthetic Media
19. Advanced Robotics
20. AI in Cybersecurity
21. Digital Twins
22. Sustainable Technology
23. Telemedicine
24. Nanotechnology
25. Hybrid Work Technologies

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

GENERATIVE AI – [1]

Short Description

Generative Artificial Intelligence (AI) is revolutionizing content creation by producing human-like text, images, and audio. Advancements in models like GPT-4o are enabling applications across various sectors, including marketing, entertainment, and education.

- OpenAI's GPT-4o: A New Era in AI
- The Age of AI Is Still in the Early Innings

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

QUANTUM COMPUTING – [2]

Short Description

Quantum computing leverages quantum mechanics to perform complex computations at unprecedented speeds. This technology holds the potential to solve problems beyond the capabilities of classical computers, impacting fields such as cryptography, material science, and pharmaceuticals.

- Quantum Computing: Progress and Prospects
- Gartner’s Top 10 Tech Trends Of 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

5G EXPANSION – [3]

Short Description

The global rollout of 5G networks is set to enhance connectivity with higher speeds and lower latency. This expansion will facilitate advancements in Internet of Things (IoT) devices, autonomous vehicles, and smart cities, fostering a more interconnected world.

- The Impact of 5G on Industries
- Top 10 Technology Trends to Watch [2025]

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

VIRTUAL REALITY (VR) 2.0 – [4]

Short Description

The next generation of Virtual Reality is focusing on more immersive and realistic experiences. Applications are expanding beyond gaming into areas like virtual meetings, education, and virtual tourism, offering new ways to interact with digital environments.

- The Future of Virtual Reality
- Gartner’s Top 10 Tech Trends Of 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

AUGMENTED REALITY (AR) – [5]

Short Description

Augmented Reality overlays digital information onto the real world, enhancing user experiences in retail, healthcare, and navigation. With advancements in AR glasses and mobile applications, this technology is becoming more accessible and integrated into daily life.

- Augmented Reality: The Next Big Thing
- Gartner's Top 10 Tech Trends Of 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

IOT IN SMART CITIES – [6]

Short Description

Internet of Things (IoT) devices are central to developing smart cities, enabling real-time data collection and management of urban infrastructure. Applications include smart traffic systems, energy-efficient buildings, and enhanced public safety measures.

- IoT and the Future of Smart Cities
- Top 10 Technology Trends to Watch [2025]

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

BIOTECHNOLOGY IN AGRICULTURE – [7]

Short Description

Biotechnological innovations are transforming agriculture through genetically modified crops, precision farming, and sustainable practices. These advancements aim to increase yield, reduce environmental impact, and ensure food security.

- Biotechnology's Role in Sustainable Agriculture
- Top 10 Technology Trends to Watch [2025]

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

AUTONOMOUS VEHICLES – [8]

Short Description

Self-driving cars and drones are progressing rapidly, with potential to revolutionize transportation and logistics. Companies are investing heavily in developing safe and efficient autonomous systems for personal and commercial use.

- The Road Ahead for Autonomous Vehicles
- Top 10 Technology Trends to Watch [2025]

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

BLOCKCHAIN BEYOND CRYPTOCURRENCY – [9]

Short Description

Blockchain technology is finding applications beyond cryptocurrencies, including supply chain management, secure voting systems, and digital identity verification. Its decentralized nature offers enhanced security and transparency across various industries.

- Blockchain's Expanding Horizons
- Gartner's Top 10 Tech Trends Of 2025

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

EDGE COMPUTING – [10]

Short Description

Edge computing processes data closer to its source, reducing latency and bandwidth usage. This approach is essential for real-time applications like autonomous vehicles, IoT devices, and remote healthcare services.

- Understanding Edge Computing
- Top 10 Technology Trends to Watch [2025]

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

PERSONALIZED MEDICINE – [11]

Short Description

Advancements in genomics and biotechnology are enabling treatments tailored to individual genetic profiles, promising more effective therapies with fewer side effects.

- Personalized Medicine Insights

- The Role of Genetics in Modern Medicine

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

NEUROMORPHIC COMPUTING – [12]

Short Description

Neuromorphic computing mimics the neural structure of the human brain, offering more efficient processing for tasks like AI and robotics.

- Neuromorphic Computing Explained
- Applications of Neuromorphic Chips

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

GREEN ENERGY TECHNOLOGIES – [13]

Short Description

The focus on renewable energy continues to grow, with advancements in solar, wind, and energy storage solutions driving sustainability efforts.

- Renewable Energy Innovations
- Green Energy Trends

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

WEARABLE HEALTH MONITORS – [14]

Short Description

Wearable devices now provide real-time health insights, such as heart rate, oxygen levels, and early disease detection.

- Trends in Wearable Health Tech
- The Future of Wearables

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

EXTENDED REALITY (XR) FOR TRAINING – [15]

Short Description

Extended reality technologies are reshaping training in sectors like healthcare, manufacturing, and military by providing immersive learning environments.

- Applications of XR in Training
- Emerging XR Trends

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

VOICE-ACTIVATED TECHNOLOGY – [16]

Short Description

Voice-activated assistants like Alexa and Google Assistant are improving accessibility and user experience across industries.

- Voice Technology in Business

- The Rise of Voice AI

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

SPACE TOURISM – [17]

Short Description

Private companies such as SpaceX and Blue Origin are making commercial space travel a reality, paving the way for a burgeoning industry.

- Space Tourism’s Future
- Exploring Space Tourism

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

SYNTHETIC MEDIA – [18]

Short Description

AI-powered tools are producing synthetic media, from deepfakes to AI-generated art, reshaping creative industries while raising ethical concerns.

- Understanding Synthetic Media
- The Ethics of AI-Generated Content

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

ADVANCED ROBOTICS – [19]

Short Description

Robotics advancements are enabling automation in manufacturing, healthcare, and service industries, boosting efficiency and safety.

- The Future of Robotics
- Emerging Robotics Technologies

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

AI IN CYBERSECURITY – [20]

Short Description

AI-driven cybersecurity solutions are helping organizations predict, prevent, and respond to sophisticated cyber threats.

- AI's Role in Cyber Defense
- AI in Security Solutions

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

DIGITAL TWINS – [21]

Short Description

Digital twins, virtual models of physical objects, are transforming industries like manufacturing, urban planning, and healthcare.

- What Are Digital Twins?

- The Role of Digital Twins in Industry

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

SUSTAINABLE TECHNOLOGY – [22]

Short Description

Eco-friendly innovations are driving sustainability, from green manufacturing practices to energy-efficient devices.

- Sustainability Through Technology
- Green Tech Trends

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

TELEMEDICINE – [23]

Short Description

Telemedicine continues to expand, offering virtual healthcare services that improve access to medical care worldwide.

- Telemedicine's Growth
- Impact of Virtual Healthcare

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

NANOTECHNOLOGY – [24]

Short Description

Nanotechnology is making strides in medicine, materials science, and energy, offering solutions at an atomic scale.

- The Impact of Nanotechnology
- Future Trends in Nanotech

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

HYBRID WORK TECHNOLOGIES – [25]

Short Description

As hybrid work becomes the norm, technology like collaboration platforms and remote work tools are transforming productivity.

- Hybrid Work Trends
- Top Tools for Hybrid Teams

https://www.ssbm.ch/top-25-emerging-technology-trends-to-watch-in-2025/

TECHNOLOGIES “CARDS”

WEF Strategic Intelligence

DIGITAL PERISCOPE 2018

TECHVISION 50

SSBM Geneva

Fynd Academy

10

AI FOR SCIENTIFIC DISCOVERY

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

ALTERNATIVE LIVESTOCK FEEDS

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

CARBON CAPTURING MICROBES

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

10

ELASTOCALORICS

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

GENOMICS FOR TRANSPLANT

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

HIGH ALTITUDE PLATFORMS

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

10

IMMERSIVE TECHNOLOGY FOR THE BUILD WORLD

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

INTEGRATED SENSING AND COMMUNICATION

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

PRIVACY ENHANCING TECHNOLOGIES

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

10

RECONFIGURABLE INTELLIGENT SURFACES

WEF STRATEGIC INTELLIGENCE - TOP 10 Emerging Tech (2025)

ADVANCED ENERGY SOLUTIONS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

AEROSPACE AND AVIATION

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

ADVANCED MATERIALS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

ARTIFICIAL INTELLIGENCE

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

AUTOMOTIVE AND NEW MOBILITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

BATTERIES

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

BEHAVIOURAL SCIENCES

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

BLOCKCHAIN

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

CLEAN POWER FOR INDUSTRY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

CO2 CAPTURE, UTILIZATION AND STORAGE

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

CYBERSECURITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

DATA SCIENCE

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

DIGITAL COMMUNICATION

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

DIGITAL IDENTITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

DISINFORMATION

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

DRONES

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

ELECTRICITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

ENERGY TRANSITION

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

FLEXIBLE BATTERIES

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

FLEXIBLE NEURAL ELECTRONICS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

GEOPOLITICS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

GLOBAL GOVERNANCE

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

GLOBAL NEW MOBILITY COALITION

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

GLOBAL RISKS

GOVTEC

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

HEAVY INDUSTRY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

HYDROGEN

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

MOBILITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

NET ZERO CARBON CITIES

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

NUCLEAR SECURITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

OIL AND GAS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

RENEWABLE ENERGY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

(SDGS)

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

SEMICONDUCTORS

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

SPACE

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

SUPERCONDUCTIVITY

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

SUPPLY CHAIN AND TRANSPORT

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

SUSTAINABLE DEVELOPMENT

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

TRANSPORT

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

TRAVEL AND TOURISM

WEF STRATEGIC INTELLIGENCE - Topics of strategic importance (2025)

WEARABLES

WEF STRATEGIC INTELLIGENCE -Topics of strategic importance (2025)

ARTIFICIAL INTELLIGENCE #AI / MACHINE LEARNING / DEEP LEARNING

DIGITAL PERISCOPE 2018

INTERNET OF THINGS #IOT / #IIOT & SENSORS & WEARABLES

DIGITAL PERISCOPE 2018

MOBILE & SOCIAL INTERNET — ADVANCEMENTS, SOCIAL NETWORKS/MEDIA, SEARCH, MESSENGING AND LIVESTREAMS

DIGITAL PERISCOPE 2018

BLOCKCHAIN — CRYPTOCURRENCIES, DISTRIBUTED LEDGER SYSTEMS, DAOS, DAPPS

DIGITAL PERISCOPE 2018

BIG DATA — APPS, INFRASTRUCTURE & PREDICTIVE ANALYTICS

DIGITAL PERISCOPE 2018

AUTOMATION — INFORMATION, TASK, PROCESS, MACHINE, DECISION & ACTION

DIGITAL PERISCOPE 2018

ROBOTS INCL. DRONES & AUTONOMOUS VEHICLES — CONSUMER/COMMERCIAL/INDUSTRIAL ROBOTS AND ROBOTICS

DIGITAL PERISCOPE 2018

IMMERSIVE MEDIA — #VR / #AR / #MR / 360°

DIGITAL PERISCOPE 2018

MOBILE TECHNOLOGIES & ADVANCEMENTS — INFRASTRUCTURE, NETWORKS, STANDARDS, SERVICES & DEVICES

DIGITAL PERISCOPE 2018

CLOUD COMPUTING — SOFTWARE-AS-SERVICE (SAAS), INFRASTRUCTURE-AS-A-SERVCIE (IAAS), PLATFORM-AS-A-SERVICE (PAAS) & MESH APPS

DIGITAL PERISCOPE 2018

3D PRINTING — ADDITIVE MANUFACTURING AND RAPID PROTOTYPING

DIGITAL PERISCOPE 2018

CX — CUSTOMER JOURNEY, EXPERIENCE, PERSONALIZATION & COMMERCE TOOLS

DIGITAL PERISCOPE 2018

ENERGYTECH — EFFICIENCY, STORAGE & DECENTRALIZED GRID

DIGITAL PERISCOPE 2018

CYBERSECURITY INCL. ADAPTIVE SECURITY — SECURITY, INTELLIGENCE DETECTION, REMEDIATION & ADAPTATION

DIGITAL PERISCOPE 2018

VOICE ASSISTANTS -INTERFACES, CHATBOTS & NATURAL LANGUAGE PROCESSING

DIGITAL PERISCOPE 2018

NANOTECHNOLOGY – COMPUTING, MEDICINE, MACHINES + SMART DUST

DIGITAL PERISCOPE 2018

COLLABORATIVETECH — CROWD, SHARING, WORKPLACE & OPEN SOURCE PLATFORMS & TOOLS

DIGITAL PERISCOPE 2018

HEALTH TECH — ADVANCED GENOMICS, BIONICS & HEALTH CARE TECH.

DIGITAL PERISCOPE 2018

HUMAN-COMPUTER INTERACTION — FACIAL/GESTURE RECOGNITION, BIOMETRICS, GAZE TRACKING

DIGITAL PERISCOPE 2018

GEO-SPATIAL TECH — GIS, GPS, MAPPING & REMOTE SENSING, SCANNING, NAVIGATION

DIGITAL PERISCOPE 2018

ADVANCED MATERIALS — COMPOSITES, ALLOYS, POLYMERS, BIOMIMICRY, NANOMANUFACTURING

DIGITAL PERISCOPE 2018

NEW TOUCH INTERFACES — TOUCH SCREENS, HAPTICS, 3D TOUCH, PAPER, FEEDBACK & EXOSKELETONS

DIGITAL PERISCOPE 2018

WIRELESS POWER

DIGITAL PERISCOPE 2018

CLEAN TECH. — BIO-/ENVIRO-MATERIALS + SOLUTIONS, SUSTAINABILITY, TREATMENT & EFFICIENCY

DIGITAL PERISCOPE 2018

QUANTUM COMPUTING — + EXASCALE COMPUTING

DIGITAL PERISCOPE 2018

SMART CITIES — INFRASTRUCTURE & TRANSPORT

DIGITAL PERISCOPE 2018

EDGE/FOG COMPUTING

DIGITAL PERISCOPE 2018

FASTER, BETTER INTERNET — BROADBAND INCL. FIBER, 5G, LI-FI , LPN AND LORA

DIGITAL PERISCOPE 2018

PROXIMITY TECH. — BEACONS, RFID, WI-FI, NEAR-FIELD COMMUNICATIONS & GEOFENCING

DIGITAL PERISCOPE 2018

NEW SCREENS — NEXT EVOLUTION TVS, DIGITAL SIGNAGE, OOH, MICROLEDS & PROJECTIONS

DIGITAL PERISCOPE 2018

DIRECT AIR CARBON CAPTURE AND STORAGE (DACCS)

TECHVISION 50

PERSONALIZED MEDICINE

TECHVISION 50

BIO-BASED ENERGETICS

TECHVISION 50

HUMANOID ROBOTS

TECHVISION 50

SODIUM-ION BATTERIES

TECHVISION 50

QUANTUM SENSORS

TECHVISION 50

MICROLED DISPLAYS

TECHVISION 50

BRAIN-COMPUTER INTERFACES

TECHVISION 50

GRIDSCALE WIRELESS ENERGY TRANSMISSION AND CHARGING

TECHVISION 50

QUANTUM COMPUTING

TECHVISION 50

INDUSTRIAL METAVERSE

TECHVISION 50

POST-QUANTUM CRYPTOGRAPHY

TECHVISION 50

QUANTUM DOT SHORT-WAVE INFRARED (SWIR) SENSING IN AI AND MACHINE VISION

TECHVISION 50

BIOLOGICALLY INSPIRED AI

TECHVISION 50

4D PRINTING

TECHVISION 50

METAMATERIALS

AI CHIPS

HYPERSPECTRAL IMAGING

MILLIMETRE WAVE AND TERAHERTZ TECHNOLOGIES

GREEN HYDROGEN

TECHVISION 50

BIOMANUFACTURING

TECHVISION 50

BIOCATALYSTS

TECHVISION 50

SOFT ROBOTICS

TECHVISION 50

SHAPE MEMORY MATERIALS

TECHVISION 50

MATERIALS INFORMATICS

TECHVISION 50

TRANSPARENT ELECTRONICS

TECHVISION 50

REGENERATIVE AGRICULTURE

TECHVISION 50

BIOPRINTING

TECHVISION 50

RNA THERAPEUTICS

TECHVISION 50

NEUROMORPHIC COMPUTING

TECHVISION 50

CONDUCTIVE CARBON NANOMATERIALS

TECHVISION 50

LIQUID METAL ALLOYS

ADVANCED CERAMICS

MYCELIUM COMPOSITES

TECHVISION 50

SELF-HEALING MATERIALS

TECHVISION 50

TRANSPARENT SOLAR PANELS

TECHVISION 50

CHEMICAL RECYCLING

TECHVISION 50

PHOTONIC INTEGRATED CIRCUITS (PICS)

TECHVISION 50

CARBON REMOVAL CONCRETE

TECHVISION 50

EDIBLE COATINGS

METAL-ORGANIC FRAMEWORKS (MOFS)

TECHVISION 50

BIO-BASED AND DEGRADABLE BATTERIES

TECHVISION 50

SYNTHETIC BIOLOGY

GENERATIVE BIOLOGY

TECHVISION 50

QUANTUM BATTERIES

TECHVISION 50

AGRIVOLTAICS

TECHVISION 50

WEARABLE ENERGY HARVESTING

TECHVISION 50

PEROVSKITE MATERIALS

TECHVISION 50

ANTIBODY-DRUG CONJUGATES (ADCS)

TECHVISION 50

HEAT BATTERIES

TECHVISION 50

GENERATIVE AI

SSBM Geneva

QUANTUM COMPUTING

SSBM Geneva

5G EXPANSION

SSBM Geneva

VIRTUAL REALITY (VR) 2.0

SSBM Geneva

AUGMENTED REALITY (AR)

SSBM Geneva

INTERNET OF THINGS (IOT) IN SMART CITIES

SSBM Geneva

BIOTECHNOLOGY IN AGRICULTURE

SSBM Geneva

AUTONOMOUS VEHICLES

SSBM Geneva

BLOCKCHAIN BEYOND CRYPTOCURRENCY

SSBM Geneva

EDGE COMPUTING

SSBM Geneva

PERSONALIZED MEDICINE

SSBM Geneva

NEUROMORPHIC COMPUTING

SSBM Geneva

GREEN ENERGY TECHNOLOGIES

SSBM Geneva

WEARABLE HEALTH MONITORS

SSBM Geneva

EXTENDED REALITY (XR) FOR TRAINING

SSBM Geneva

VOICE-ACTIVATED TECHNOLOGY

SSBM Geneva

SPACE TOURISM

SSBM Geneva

SYNTHETIC MEDIA

SSBM Geneva

ADVANCED ROBOTICS

SSBM Geneva

AI IN CYBERSECURITY

SSBM Geneva

DIGITAL TWINS

SSBM Geneva

SUSTAINABLE TECHNOLOGY

SSBM Geneva

TELEMEDICINE

SSBM Geneva

NANOTECHNOLOGY

SSBM Geneva

NANOTECHNOLOGY

SSBM Geneva

HYBRID WORK TECHNOLOGIES

SSBM Geneva

ARTIFICIAL INTELLIGENCE (AI)

Fynd Academy

MACHINE LEARNING (ML)

Fynd Academy

QUANTUM COMPUTING

Fynd Academy

5G NETWORKS

Fynd Academy

BLOCKCHAIN

Fynd Academy

INTERNET OF THINGS (IOT)

Fynd Academy

AUGMENTED REALITY (AR)

Fynd Academy

VIRTUAL REALITY (VR)

Fynd Academy

EDGE COMPUTING

Fynd Academy

AUTONOMOUS VEHICLES

Fynd Academy

ROBOTICS

Fynd Academy

BIOTECHNOLOGY

Fynd Academy

GENETIC ENGINEERING

Fynd Academy

CLOUD COMPUTING

Fynd Academy

NANOTECHNOLOGY

Fynd Academy

DRONES

Fynd Academy

DIGITAL TWINS

Fynd Academy

SMART CITIES

Fynd Academy

CYBERSECURITY ADVANCEMENTS

Fynd Academy

WEARABLE TECHNOLOGY

Fynd Academy

PREDICTIVE ANALYTICS

Fynd Academy

NATURAL LANGUAGE PROCESSING (NLP)

Fynd Academy

CRYPTOCURRENCY

Fynd Academy

RENEWABLE ENERGY TECH

Fynd Academy

VOICE ASSISTANTS

Fynd Academy

SMART MANUFACTURING

Fynd Academy

3D PRINTING

Fynd Academy

SMART HEALTHCARE SOLUTIONS

Fynd Academy

CHATBOTS

Fynd Academy

AI-POWERED CYBER DEFENSE SYSTEMS

Fynd Academy

Under the patronage of **HRH Prince Khalid Al-Faisal**
Advisor to the Custodian of the Two Holy Mosques & Governor Iof Makkah Region

CONFERENCE OMAINTEC 2025 EXHIBITION FM

المؤتمر الدولي الثاني والعشرون لإدارة الأصول والمرافق والصيانة

The 22nd International Asset, Facility & Maintenance Management Conference

Digitization - Excellence - Sustainability

THANK YOU!

26-28 January 2025
The Ritz-Carlton Jeddah, Kingdom of Saudi Arabia

An Intiative By

OMAINTEC
المجلس العربي لإدارة الأصول والمرافق والصيانة
Arab Asset, Facility and Maintenance Management Council

Organized by

TSG | EXICON.
The Specialist Group • شركة مجموعة المختص

www.omaintec.com #OmaintecConf