Agenda

- Bombardier implementation of ERTMS Regional
- ERTMS Regional outside Europe
- Leading the way to mainline level 3
- Future possibilities
Bombardier implementation of ERTMS Regional

- Bombardier has developed a generic product, *INTERFLO 550*, that fulfils the requirements for ERTMS Regional, as set out by UIC and Swedish Trafikverket.

- The development of *INTERFLO 550* aimed to cover all known requirements for ERTMS/ETCS Level 3, as described in the Official Journal Of The European Union, 16 October 2006:
  - Providing track clearance information to the interlocking
  - Train integrity supervision function supported via detection equipment located on the rolling stock
Bombardier implementation of ERTMS Regional

- The generic application for Trafikverket ERTMS Regional is based on the Bombardier product *INTERFLO 550*:
  - *INTERFLO 550* is communications-based with moving block
  - *INTERFLO 550* supports communication with object controllers in open networks and over radio
  - *INTERFLO 550* supports open interfaces over IP as specified by Trafikverket/UIC
  - *INTERFLO 550* supports various track-to-train communications
    - Euroradio over circuit switched GSM-R
    - Euroradio over GPRS, digital TETRA, Wi-Fi .......... (packet switched)

- The generic application for TRV incorporates:
  - Virtual fixed block
  - 30 simultaneous train movements controlled by one Train Control Centre (IL/RBC)
  - OC communication over leased public IP link
INTERFLO 550 / ERTMS Regional as lineblock

L0 or 2

EBI Screen Control room
EBI Lock 950 R4 Interlocking
OCS 950 Object Controller System
EBI Track Train detection
EBI Light Optical signal
EBI Switch Point machine

L0 or L3

TCP/IP
TCC, Train Control Centre
TIMS, Train integrity management system
EBI Link Fixed balises
EBI Gate Level crossing

L0 or 2

EBI Lock 950 R4 Interlocking
EBI Cab 2000 ETCS Onboard

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ERTMS Regional is tested outside Europe

- Level 0/2 in stations, *INTERFLO550* with moving block between stations
- First system planned to be inaugurated in June, second system planned in July
- Two more lines are being engineered
- The GA for incorporates:
  - *BOMBARDIER* ETCS onboard but with IP communication over TETRA
  - TIMS device modified to interface directly to ETCS
Leading the way to Level 3

- **INTERFLO 550** incorporates the basic functionalities for Level 3
  - Moving block
    - Track occupancy and clearance based on position report and train data
    - Headway limited only by brake capability and poll rate
  - Train integrity monitored onboard the train
    - TIMS device connected directly to ETCS
  - Handover to/from adjacent RBC/interlocking
    - RBC-RBC handover to Level 2 and Level 3 systems
    - Relay interface to traditional interlocking

**Diagram:***
- Dynamic Speed Profile
- Static Speed Profile
- Virtual Occupancy
- Movement Authority
- Maximum speed according to calculated dynamic speed profile

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Migration Path to Level 3

- **INTERFLO550** has been implemented to allow for a smooth transition to Level 3 operation.
  - As an overlay on a L0 interlocking, unequipped vehicles are given exclusive right to the track from signal to signal.
  - Level 2 equipped trains are controlled with CAB signalling
  - Level 3 equipped trains are allowed to follow Level 3 trains with moving block
  - Level 2 equipped trains can be allowed to follow Level 3 train with moving block

- **Instant capacity gain from Level 3 operation on existing lines**
  - Peak hour traffic very often is with EMU/DMU trains with inbuilt integrity control.
  - Unequipped or trains with no TIMS can run as L0 or L2 trains off peak or in between L3 trains
Leading the way to Level 3

- End of train detection
- Connects directly to ETCS

- Reports train length
- Transmits information from last car:
  - Position, brake pressure, motion status
- Charges batteries using brake air
- Controls emergency brake valve in last car
Future possibilities

- Level 3 as an overlay on Level 0 or L2
  - Trains following trains with TIMS travel in Level 3
  - Trains following other trains travel in Level 2 (or 0)
- GPS positioning of trains
  - Cold movement detection
  - Augmentation of start-up position
  - To supplement or replace balises
Future possibilities

- **Integration with driving style manager**
  - L3 results in better real time control of vehicle movements
    - Better control can be used for energy optimization
    - Achieving “Golden run” to optimize meeting other trains on single track lines or overtaking slower trains on double track lines

- **Increased/Improved functionality in the Hand Held Terminal**
  - Work crew location augmented by GPS positioning
  - Remote control of points in shunting areas