TRANSNET freight rail

BACK TO THE FUTURE

Biennial Symposium: 10 – 11 October 2012

Long Term Train Authorisation Solutions

Introduction to concepts and international trends

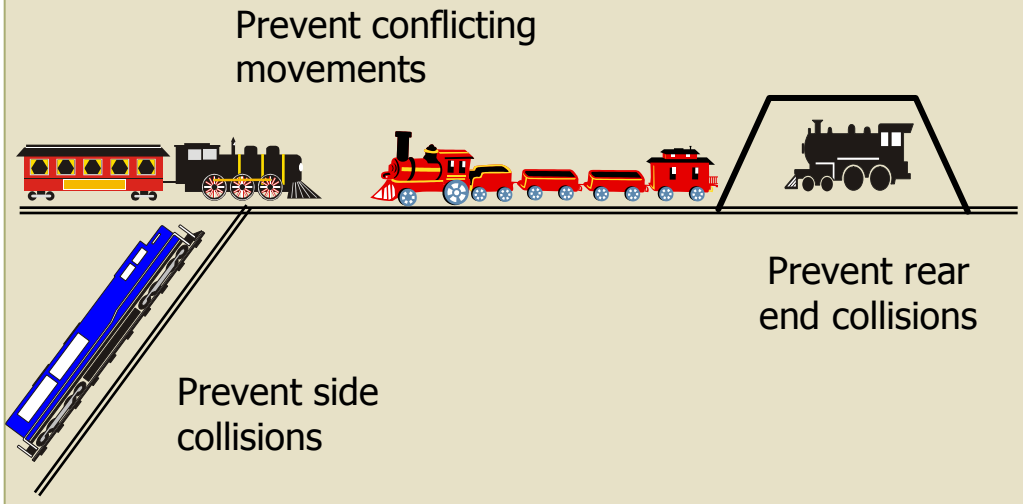
saice

RAILWAY & HARBOUR DIVISION

CONTINUING EDUCATION
UNIVERSITY OF PRETORIA

Need for Train Authorisation Systems (TAS)

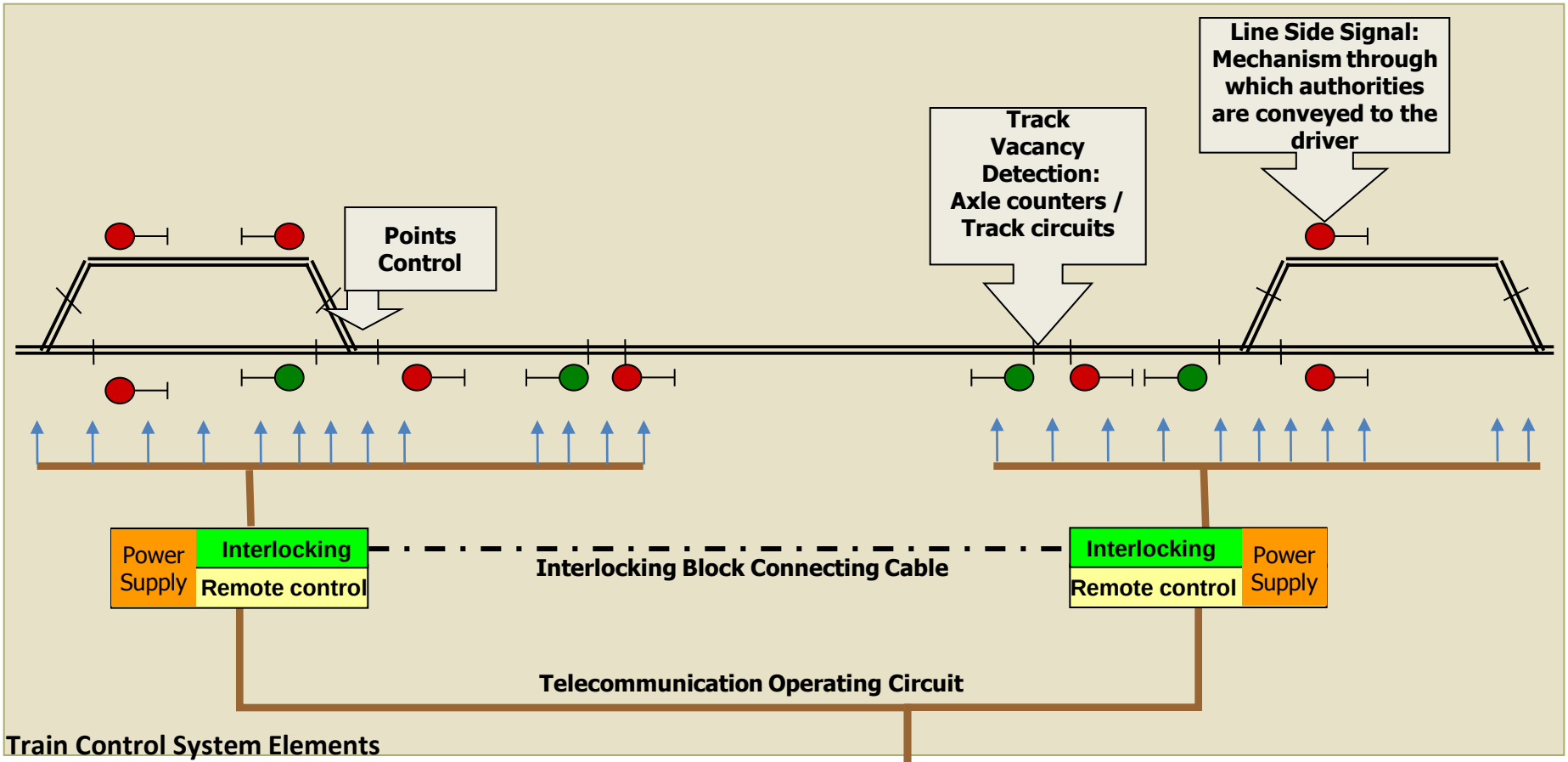
Purpose of a Train Authorisation System is to safely maximise capacity



Definition

- **A system or method of safely generating and conveying train movement authorities from the Train Control Officer to the train driver for a train to move safely from one point to another.**
- **The number of trains that can safely be authorised in a section is determined by the specific technology in use in a section.**
- **Before a driver is authorised to proceed at least the following conditions must be met:**
  - **–The route has to be available i.e. the route is not occupied by any other train.**
  - **–No conflicting movements been issued.**
  - **–The movement is protected from sideward collisions.**
- **The route is locked if all conditions are met.**
- **The signal turns from red to proceed e.g. green.**

General Elements of a Line-side Signalling System



Train Control System Elements

- Signalling Interlocking Systems
- Track Vacancy or Train Occupancy Detection
- Points Throwing Systems
- Railway Signalling Interface to Driver
- Power Supply
- Remote Control
- Traffic Control Centre

Worldwide trends – Europe: ETCS

ETCS

- **What is ETCS?**

Outcomes

- **European Train Control System (ETCS) is a jointly developed set of standards for signalling in Europe. Development is coordinated by the UIC and includes representatives from the Unisig contractors**
  - **System allows for interoperability between railways.**
  - **Although the interfaces for the system have been developed, full inter-changeability between different suppliers equipment is not possible**
  - **There are various levels of complexity of the system which can be implemented.**
  - **All levels are vital.**
  - **All levels have the ability to enforce speed and limit of authorities**
    - **Functions as an Automatic Train Protection**

Worldwide trends – Europe: ETCS

ETCS

- **What are the elements of an ETCS solution?**

Outcomes

- **All levels of the system use the following elements:**
  - **Eurobalises: which convey information of the route ahead**
  - **Interlocking: which ensures that conflicting authorisations can not be issued**
  - **GSM-R : used for both voice and data communications to the trains.**
  - **Points**
  - **A mechanism to communicate to the driver**

Worldwide trends – Europe: ETCS

ETCS

- What are the various levels of ETCS and their functions?

Outcomes

- Level 1: This is the most basic of systems.
  - It utilises the existing signalling system and adds ATP functionality on top of the signalling system. This is called an overlay.
  - Separation between trains is accomplished by means of the existing signalling.
- Level 2: This level provides onboard authorisation to the driver.
  - All authorisations are communicated into the cab of the locomotive by GSM-R radio.
  - ATP is inherent to the system.
  - The signals are retained for fallback procedures only.
  - Track circuits and axle counters are still used for train detection

Worldwide trends – Europe: ETCS

ETCS

- **What are the various levels of ETCS and functions?**

Outcomes

- **Level 3: Standards for this system have not been fully developed.**
  - **There aren't any instances of the full solution deployed although there is a version being tested in Sweden.**
  - **There is no line side infrastructure deployed other than eurobalises and points throwing mechanisms.**
  - **System uses moving block for distance separation.**

Worldwide trends – USA : PTC

PTC Technology

- **What is PTC?**

- **Why is it being implemented?**

Outcomes

- This is a non-vital overlay system.
  - –System is able to enforce speed and limits of authority.
    - Functions as an Automatic Train Stop (ATS)
  - –Existing signalling is retained
  - –Interoperability between railroads is a fundamental requirement
  - –System does not control the headway between successive trains

- Congress mandated the deployment of PTC
- Legislated through the Rail Safety Improvement Act of 2008 after the Chatsworth accident

Worldwide trends – USA : PTC

PTC Technology

- What are the timelines for the deployment of the technology?
- Challenges associated with the deployment of the technology

Outcomes

- The technology is immature.
  - Specification for the system has not been finalised including the communications module.
  - The data radio for the system has not been developed.
- The extremely tight fixed deadline has created several challenges:
  - Resource and capacity constraint in the industry
  - "Knee-jerk" reaction and was not the strategic direction that would have been taken

Worldwide trends – USA : PTC

PTC Technology

- **Are there any benefits of the technology?**

Outcomes

- **The technology is intended to improve safety**
  - **Supposed to protect against human error.**
  - **Some US railroads don't believe that there will be a significant improvement**
    - **Railroads had made significant improvements in this regard**
    - **Cost to benefit ratio is too low**
      - **$22 spent : $1benefit**

Why do we need to adapt the TAS solution?

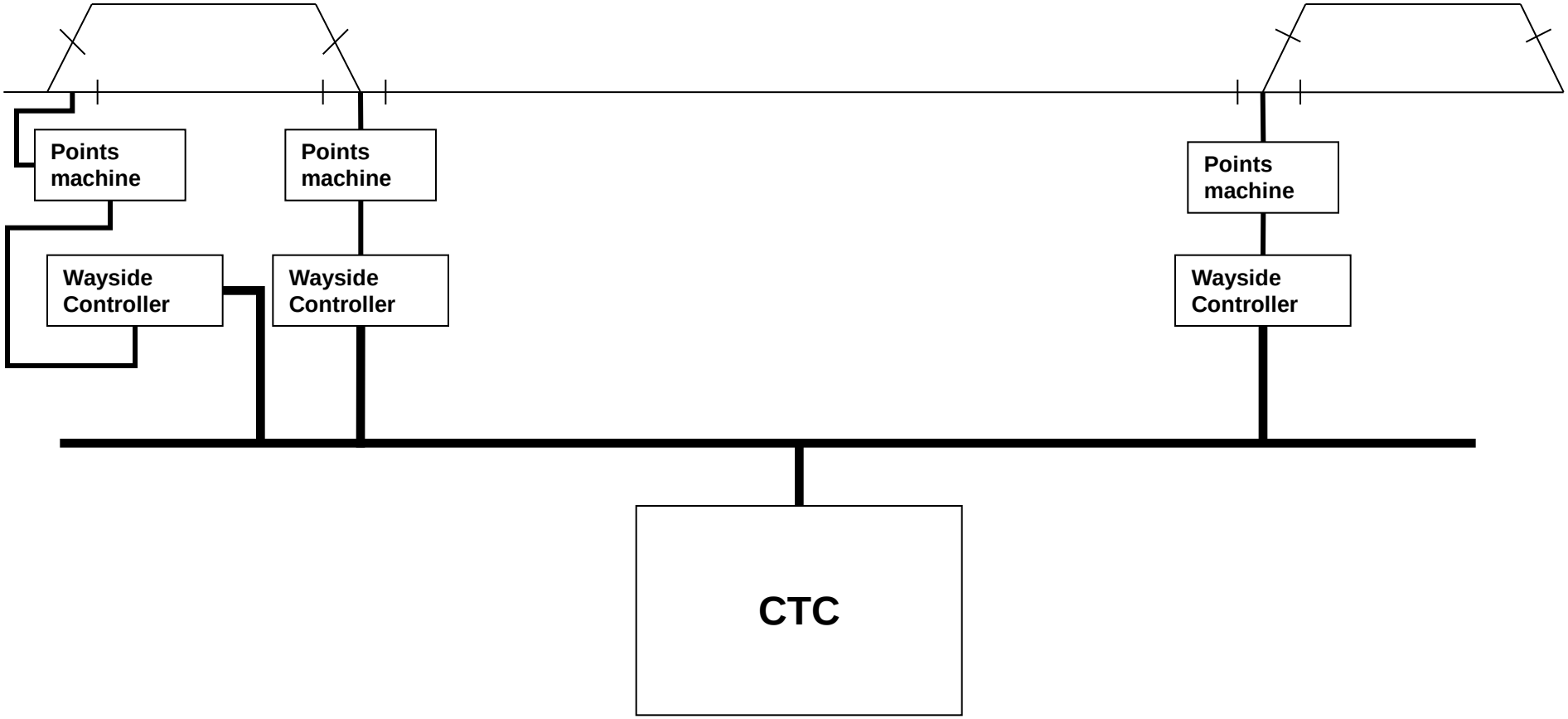
Requirements for TAS

- Existing technology is reaching its end of life
- Creation of an efficient and flexible train control layer
  - Technology
  - Processes
  - Skills
- Improved safety

Challenges with the existing system

- Increasingly prone to the obsolescence of spares.
- Decreasing availability of skills
- Equipment is geographically dispersed and vulnerable to theft/vandalism
- Long lead times before personnel operate independently
- Unable to make changes to the system quickly (flexibility)
- Unable to enforce speed limits and limits of authority on signalled lines

Worldwide Trends – Australia: ATMS
- South Africa: CBA



What is Communications Based Authorisation (CBA)?

- **CBA is a completely different method of authorising trains**

  - **The authorisation is transmitted directly into the locomotive via a radio based communication system**
  - **The train position detection is done primarily by non – ground based systems**
  - **The train completeness is done by the train**
  - **The CBA system prevents the driver from over speeding and exceeding his/her extent of authority**
  - **CBA also controls the headway between trains i.e. the distance separation between trains**
  - **This type of technology is a pre-requisite to move towards single driver operation and Automatic Train Operation (ATO)**

CBA: Comparison to requirements

Requirements for TAS	Comparison to requirements
• Existing technology is reaching its end of life	• Technology is being developed ➢ Versions of solution being deployed worldwide
• Creation of an efficient and flexible train control layer – Technology – Processes – Skills	• Minimal line side equipment with centralised diagnostics • Decreased opportunity for theft • Predictive diagnostics to focus maintenance interventions • Uses advanced technologies which are more aligned with current tertiary training • Can reduce the time to train people • Flexible headway means that there is improved flexibility in operations
• Improved safety	• System manages the train separation • Enforces the speed limits and limits of authority

CONCLUSION

- The future direction of train authorisation technology is uncertain
- Railways have different requirements (high speed vs freight)
- Telecommunications and satellite positioning will become more important
- A new approach to train authorisation will be implemented in the medium to long term