Australia’s First Fully Automated Metro
Opportunities & Solutions
Oliver Fried – Technical Director, Sydney Metro
Overview

- Sydney’s rail future - Opportunities for metro
- Project features & performance
- Fully automated operations - Technical solutions
- Project challenges – Metro City & Southwest
- Skills investment
- Summary
Features of Sydney Metro

**Key Facts**
- **2019**: Sydney Metro Northwest opens
- **2024**: Sydney Metro City & Southwest opens
- **31** stations
- **10**: Off peak train every 10 minutes
- **98%**: On-time running reliability
- **4000**: Commuter car parking spaces (Northwest)
- **No timetable**: just turn up and go
- **Opal ticketing**: like rest of Sydney
- **Ultimate capacity**: a train every two minutes each way under the CBD

**Train Features**
- Three double doors per carriage for faster loading and unloading
- Level access between platform and train
- Wheelchair spaces, separate priority seating and emergency intercoms
- Real-time travel information and live electronic route maps
- 26 CCTV cameras per train; inside you can see from one end of the train to the other and video help points
- Platform screen doors keep people and objects away from the edge and allow trains to get in and out of stations much faster
- 170 metres long platforms - longer than most of Sydney
- Clean platforms and trains
- Heating and air conditioning

**Safety**
- Sydney Metro is Australia's first fully-automated metro rail network
- Around the world, millions of people use these networks every day in cities like Paris, Singapore, Dubai and Hong Kong

**Operations Control Centre**
- State-of-the-art network controlled from new high-tech facility at Tullawong Road
- Constant monitoring: Expert train controllers monitor entire metro system
- Security: More than 230 tunnel cameras

**Signalling and Communications Systems**
- Control the trains, tunnels, platforms and skytrain to deliver a safe and reliable journey

**Faster Journeys**
- System minimise the time trains are stopped at stations and the time between each train

**Customer Service Assistance**
- Customer service assistants at every station and moving through the network during the day and night
**Project Overview**

- **Stage 1 – 36km**
- **15 km Twin Tunnels - Complete**
- **8 new stations; 5 upgraded**
- **Train Maintenance Facility**
- **4,000 car spaces**
- **Open first half of 2019**

Legend:
- Sydney Metro Northwest alignment (tunnel)
- Sydney Metro Northwest alignment (skytrain)
- Sydney Metro City & Southwest alignment
## Line Capacity

- Sydney’s Rail Future identifies passenger demand
- Customer service “turn up & go”. Service frequency to fulfil waiting times

<table>
<thead>
<tr>
<th></th>
<th>Trains per hour in peak</th>
<th>Train Formation</th>
<th>Passenger capacity / train</th>
<th>Passengers / hour /direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sydney Metro NW at opening</td>
<td>15</td>
<td>6 car</td>
<td>1152</td>
<td>17,280</td>
</tr>
<tr>
<td>Sydney Metro NW Capacity</td>
<td>25</td>
<td>6 car</td>
<td>1152</td>
<td>28,800</td>
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<tr>
<td>Safeguarded Capability</td>
<td>30</td>
<td>8 car</td>
<td>1440</td>
<td>&gt;40,000</td>
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# KPI Performance Drivers

<table>
<thead>
<tr>
<th>Availability</th>
<th>Service Availability</th>
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<tbody>
<tr>
<td>Timeliness</td>
<td>Frequency</td>
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<tr>
<td></td>
<td>Journey Time</td>
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<tr>
<td>Service Quality</td>
<td>Train Cleanliness, Condition and Graffiti</td>
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<td></td>
<td>Station Cleanliness, Condition and Graffiti</td>
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<td>Precincts and Corridor Condition and Graffiti</td>
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<td></td>
<td>Customer information during disruption</td>
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<td>Gate Management</td>
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<td></td>
<td>Customer Satisfaction Survey</td>
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<td>Customer Complaints and complaints resolution</td>
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<tr>
<td>Asset Functionality</td>
<td>On-train environment (temperature and lighting)</td>
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<tr>
<td></td>
<td>Station environment (temperature and lighting)</td>
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<tr>
<td></td>
<td>Lift and Escalator Operations</td>
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<tr>
<td></td>
<td>Other Assets Availability (CCTV, Help Points, PID Announcements and Induction Loop)</td>
</tr>
</tbody>
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Performance Criteria

A design that must be capable of delivering:

- Sufficient capacity for passenger demand
- Acceptable waiting time: Peak - 4 mins in & off-peak - 10 mins
- 98% of required train services on-time
- A 37 minute journey time

- Benchmarked against proven contemporary systems & technology applications
- Aligned to systems available in the market - Minimal technical development
OTS – Operations Trains & Systems PPP

- Northwest Rapid Transit (NRT)
- Permanent physical works include:
  - Delivery of 22 x 6 car fully automated trains
  - Integrate track, power supplies, M&E systems, signalling and communications systems
  - Build the Sydney Metro Train Facility (SMTF)
  - Build 8 new stations, interchange facilities & car parks
  - Upgrade and convert the Epping and Chatswood rail link
- Operate & Maintain Sydney Metro Northwest for 15 Years
Technology - Rolling Stock

- Unattended (UTO) operation Safe & reliable in all driving modes GoA4 (IEC 62290)
- Driving, braking & door commands - Authorisation, response, accuracy & integrity
- Interfaces with signalling, platform screen doors & communications to / from OCC
- Passenger capacity – 1152 (30% seated)
- Performance outcomes underpinned by International Standards.

Product Solution: Alstom Metropolis – Proven product platform in similar metro applications

Referenced applications: Singapore NE & Circle Lines & Hong Kong MTR South Island Line
Rolling Stock
Interiors & passenger information
Technology - Signalling & Train Control

- Unattended train operation (UTO) – GoA4 (IEC 62290)
- Safe braking distance between trains.
- Interfaces with rolling stock, platform screen doors & communications
- Automatic Train Supervision:
  - Driving profile and dwell times regulated automatically to achieve run times, optimise performance & manage delays
  - Fault reporting & alarms to OCC with recording & playback
  - Vehicle / system performance captured to support maintenance

Product Solution: Communication Based Train Control (CBTC)  
Alstom Urbalis 400 – Proven in comparable metro applications

Referenced applications: Singapore NE & Circle Lines, Shanghai Line 10 & Hong Kong MTR South Island Line.
Communication Based Train Control (CBTC)

Location of preceding train communicated to following train in real time
Train Control and Signalling

OPERATIONG MODES

- Wake Up Mode
- Unattended Train Operation (UTO)
- Protected Manual Mode (PM) – Manual with ATP supervision
- Restricted Mode (RM) – Manual with partial ATP supervision to 25 km/h
- Fallback Mode – Manual driving to procedure
- Wash Mode
Train to Lineside Communications

Signalling
- 5.8 GHz WiFi
- Low data
- High integrity
- Dual-redundant

Communications
- 5.8 GHz WiFi *
- High data
- 8 video streams per train
- 25 frames per second
- 32 video streams total
- Remote PA & “Help-Point” voice communications

* Subject to proving trials
Technology - Platform Screen Doors

- Segregation of passengers at platforms from track & moving trains
- Platform screen doors (PSDs) at 3 new underground stations
- Platform Edge Barriers (PEBs) at all other stations
- Synchronised with train doors - Authorisation, timing sequence & interdependent isolations (Interfaces via signalling system)
- Obstacle detection on both train and platform doors
- Events & failure mode indications reported to OCC. Relevant CCTV images displayed automatically
Platform Screen Doors and Platform Edge Barriers
Artists Impression of Cudgegong Road Station
Security and Intrusion Protection

- Perimeter monitored and alarms
- CCTV for stations and precincts
- Tunnel and guideway physically segregated
- Segregation of staff at SMTF
Sydney Trains Rail Facility (SMTF)

- Stabling for fleet, initially 22 trains
- Fully automated train movements
- 4 road maintenance facility. Full train lift and bogie exchange
- Dual axle wheel lathe
- Automatic train wash plant, graffiti and biological cleaning
- Stores, workshop and rail maintenance capability
- Stabling for maintenance fleet
Artists impression of Sydney Metro Trains Facility
Sydney Metro City & Southwest
Tunnel - Chatswood to Sydenham
The Bankstown Line
7 New Underground stations
Total line length 65 km
31 metro railway stations
Augmentation and Performance Targets

- Rail systems design to cater for an expanded Sydney Metro
- System reliability and availability outcomes address the extended Metro with system performance targets recognising full expansion
- The augmented Metro including additional stations, track, trains and maintenance capacity
- The SM NW performance targets are
  - 98% of Trains Services within 2 minutes of due time
  - 99.5% of Trains Services
  - Rail systems reliability and availability structured for the full line (SM NW + SM C&SW)
Skills Investment
The Changing Shape Skills in Rail

- Signalling Mechanical
- Signalling Electrical
- Communications and Control Systems
Sydney Metro – Workforce Development Programs

Key Objectives

- Support local labour force participation
- Resolve skills shortages locally and nationally through targeted skills development
- Maintain competitiveness of the construction sector by attracting skills locally and nationally
- Ensure procurement decisions in the transaction management phase support state and federal efforts to increase workforce participation
- Encourage the next generation to pursue careers in engineering and construction
Sydney Metro Workforce Development Programs

Metro Graduates

Specialist Graduate Program targeting Communication and Control Systems

Metro Career Pathways

Careers Development – aligning with STEM Programs in schools

Opportunity to develop world leading skills from the increase in semi and fully-automated train systems across the world

Specialised Curriculum

Development of new qualifications supporting different occupational requirements

Partnering with RTO’s to develop specialised Communications & Control Systems curriculum

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Partnering with RTO’s to develop specialised Communications & Control Systems curriculum
Opportunities and Solutions

- Performance based specifications – Service outcomes, frequency and reliability
- Proven solutions - Delivering Metro outcomes utilizing proven products and technologies to international standards
- Integration of trains, signalling, PSD and communications technologies
- Sydney Metro - Provisioned to extend (Augmentation)
- Shift in skills – New technologies, less bespoke, integration, operations and maintenance