

CAPABILITY STATEMENT

HYDROGEN FUEL CELL BUSES



WE OPERATE ENGLAND'S LARGEST FLEET OF HYDROGEN BUSES

We have been operating hydrogen fuel cell buses in partnership with Transport for London since 2011 and currently operate and maintain 10 hydrogen buses as part of the project 3Emotion (Environmentally Friendly, Efficient, Electric Motion).

We believe hydrogen fuel cell buses can easily, affordably and efficiently replace large fleets of diesel powered buses in terms of capacity and performance.

The hydrogen buses are refuelled using a system that delivers gaseous hydrogen in a comparable time to the refuelling of diesel bus using the same refuelling process and procedures.

Transit Systems is pleased to become a member of Hydrogen Mobility Australia.

Hydrogen Mobility Australia's vision is a hydrogen society built upon clean and renewable energy technology, including hydrogen powered transport. We are pleased to join a collection of vehicle manufacturers, oil & gas companies, infrastructure providers, research organisations, financial institutions and governments with a mission to make this hydrogen vision a reality.



“OUR HYDROGEN FUEL CELL FLEET IN LONDON OPERATES 17 HRS PER DAY, 7 DAYS A WEEK”

**GREG BALKIN
GENERAL MANAGER
NEW TECHNOLOGY AND PROJECTS**



PROJECT OVERVIEW

OPERATION OF 10 HYDROGEN FUEL CELL BUSES

- Busy London route
- 17 hours per day, 7 days per week
- Operating as a normal bus service
- Operation and Maintenance undertaken by Tower Transit
- Over 70 drivers trained
- Fuelling infrastructure located at Tower Transit's Lea Interchange Bus Depot

BUS OVERVIEW

ISE / WRIGHTBUS HYDROGEN FUEL CELL BUS

- Ballard FCvelocity HD-6 75kW fuel cell
- Dynetek hydrogen storage system
- 30kg gaseous hydrogen at 350bar @ 15°C
- Super Capacitor energy storage
- VDL SB-200 chassis
- Wrightbus bodywork
- Length -11.895m
- Width - 2.520m
- Weight - 11350kg
- 34 seated + 10 standees (one wheelchair position)



Our London hydrogen bus operation is part of the **Environmentally Friendly, Efficient, Electric Motion (3Emotion)** project which aims to bridge the gap between current fuel cell bus demonstration projects and larger scale deployment in Europe.

Through the exchange of information about the daily operations, transport authorities will be informed about;

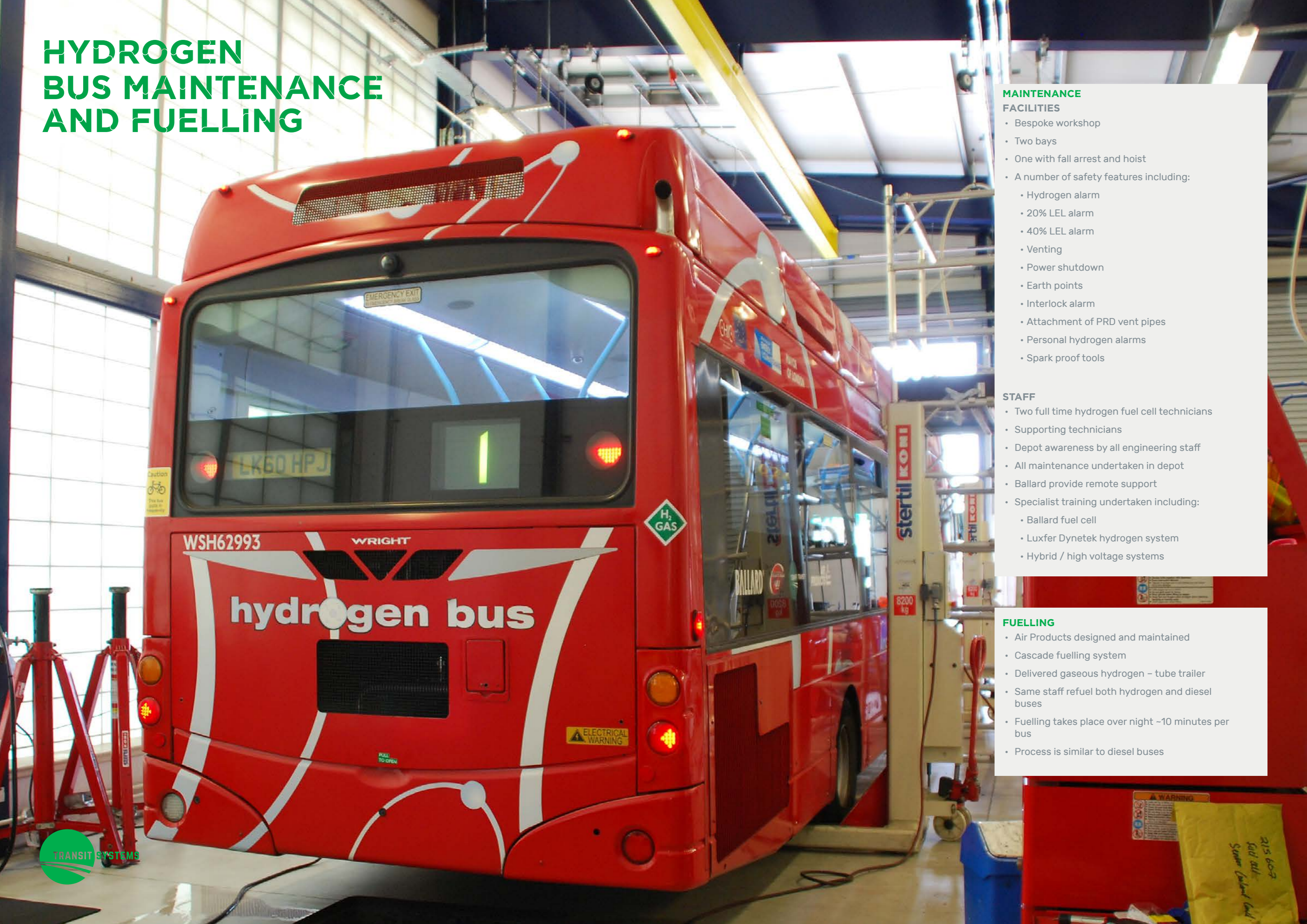
- the movement towards cost effective integration of FC Buses in local bus fleets;
- the enhancement of the technical availability of the buses;
- the common technical and safety specifications for Refueling Infrastructure are;
- the toolkit for the identification of a proper mix of incentives to support the market demand side; and
- the evolution of fuel cell buses (from CHIC to 3Emotion).

VAN HOOL A330 FUEL CELL

- Ballard FCVelocity HD-7 83KW fuel cell
- Luxfer hydrogen storage system
- 4 cylinders
- 30kg gaseous hydrogen at 350bar @ 15°C
- Battery energy storage
- Length -11.995m
- Width - 2.550m
- Weight - 12880kg
- 34 seated + 47 standees (one wheelchair position)



HYDROGEN BUS MAINTENANCE AND FUELLING



MAINTENANCE FACILITIES

- Bespoke workshop
- Two bays
- One with fall arrest and hoist
- A number of safety features including:
 - Hydrogen alarm
 - 20% LEL alarm
 - 40% LEL alarm
 - Venting
 - Power shutdown
 - Earth points
 - Interlock alarm
 - Attachment of PRD vent pipes
 - Personal hydrogen alarms
 - Spark proof tools

STAFF

- Two full time hydrogen fuel cell technicians
- Supporting technicians
- Depot awareness by all engineering staff
- All maintenance undertaken in depot
- Ballard provide remote support
- Specialist training undertaken including:
 - Ballard fuel cell
 - Luxfer Dynetek hydrogen system
 - Hybrid / high voltage systems

FUELLING

- Air Products designed and maintained
- Cascade fuelling system
- Delivered gaseous hydrogen – tube trailer
- Same staff refuel both hydrogen and diesel buses
- Fuelling takes place over night –10 minutes per bus
- Process is similar to diesel buses



CONTACT US

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GREG BALKIN

GENERAL MANAGER NEW TECHNOLOGY & PROJECTS

Greg has over 45 years of experience in the public transport industry. Greg has been employed by many of the most respected public transport businesses in Australia and has extensive experience and qualifications in key aspects of passenger ferry and urban bus operations, including: industrial relations, rostering, timetabling, network planning, operations management, safety systems, new technologies, as well as transitions and mobilisations.

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DAVID YORKE

NEW TECHNOLOGY & PROJECTS MANAGER

A Chartered Engineer and qualified to Master Degree level in both Hydrogen Safety Engineering and Electronics, David has worked on zero and low emission buses for the last ten years.

David was involved in the preparation of the London hydrogen fuel cell project. Helping to oversee the manufacture of the buses, the construction of the workshop and fuelling infrastructure. Now the hydrogen fuel cell buses are in service, David project manages the daily operation of the buses working in close collaboration with Transport for London and other stakeholders in the venture.

Along with being a leading authority on hydrogen fuel cell buses, David is a specialist in the technology and operation of other zero and low emission buses.

Prior to his current position, David worked in industry on new product introduction and quality. David has extensive experience of low production, high technology, manufacturing.

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