Why New Train Control?

Convergence of need for increased performance and end of life of BART train control systems

**Obsolescence:** Age of equipment; lack of parts; hard to maintain

**Performance:** Capacity, headway, run time, reliability

**O&M Costs:** High costs associated with maintenance of diversified equipment
Existing BART Systems

1972 - Original system, first fully automatic metro, Westinghouse MUX audio frequency track circuits - 74 miles
1989 - 2nd generation of Westinghouse for express tracks
1995 - GRS (Alstom) on East Bay extensions – 19 miles
1998 – New SORS – core system
2002 - Bombardier on SFO extension - 12 miles
2015 - Alstom on Warm Springs and VTA extensions - 16 miles

Plus multiple upgrades over the years
Train Control Functions

Automatic Train Control (ATC)

Automatic Train Protection (ATP) – Vital safety system that controls train speed and separation

Automatic Train Operations (ATO) – Non-vital system for station stopping and other driver functions

Automatic Train Supervision (ATS) – Non-vital system that manages train schedules and provides information and control to the OCC

Interlocking – Vital system of “gates” that control movement on tracks and over switches
### Fixed Block System and SORS

<table>
<thead>
<tr>
<th>Tk Circuit 1</th>
<th>Tk Circuit 2</th>
<th>Tk Circuit 3</th>
<th>Tk Circuit 4</th>
<th>Tk Circuit 5</th>
<th>Tk Circuit 6</th>
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<td>600</td>
<td>300</td>
<td>1000</td>
<td>1000</td>
<td>500</td>
</tr>
</tbody>
</table>

- Tk Circuit 1: Red
- Tk Circuit 2: Red
- Tk Circuit 3: Red
- Tk Circuit 4: Blue
- Tk Circuit 5: Blue
- Tk Circuit 6: Blue
Fixed vs CBTC

Overview of ATS as applied to a moving block system
Technology Advantages

Higher capacity throughput

Higher resiliency

Very little wayside installation

Power savings

Vehicle wear and tear

Facilitates maintenance activities
Technology Challenges

Staff training

Implementation

Car-borne controller change-out

Loss of control over system content and configuration
Central Computer System

Core Train Functions:
- Train tracking
- Schedule maintaining
- Train routing
- Dispatching

Command and Indication:
- Traction power
- Fire systems
- Ventilation fans
- Water pumps, valves
- Emergency generators
- UPS systems

Maintenance Data:
- Vehicle miles
- Equipment cycles
Central Computer System

**Situational Awareness:**
- Big board
- Real-Time status displays

**System Safety:**
- Work order/clearance
- Earthquake response

**Destination Signs:**
- Train destination
- Customer service messages

**Internet information:**
- Real-Time departures
- Email/Text advisories

**Graphics workstations**

**Alarm management**

**Ventilation control/automation**

**Data logging**

**Estimated arrival times**

**Advertising messages**

**Bart Service Advisories**