Panasonic CityNOW Overview
Creating Transformational Change Through Public-Private Partnerships, Stakeholder Alignment, and Innovative Solutions
DNA of Consumer Electronics

A Better Life ... With A Lifetime of Technology

Business Areas

- **Your Car**: AUTOMOTIVE & INDUSTRIAL SYSTEMS 32%
- **Your Journey**: AVC NETWORKS 14%
- **Your Business**: APPLIANCES 27%
- **Your Home**: ECO SOLUTIONS 19%
- **Your Community**: OTHERS 8%

Panasonic
Smart Cities
Global Experience, Innovation, and Results
Shioashiya

Japan

• Opened 2012
• 400 single-family homes
• 83 condos
• Net-zero energy, net-zero carbon community

Solutions include:
• Residential solar+storage
• Full smart home IoT including appliances and lighting
Tsunashima SST

Japan

• Targeting (vs. 2005) 40% lower CO$_2$ emissions & 30% lower water use
• >30% energy from solar PV, plus co-gen & fuel cells
• Community Continuity Plan for resilience and emergency services
• Town Energy Center and Smart City Management Center
• Also mobility, security, and wellness solutions
Suntrust Park &
The Battery Atlanta
Atlanta, GA
• Mixed-use development district adjacent to new, iconic property (Suntrust Park)

Solutions include:
• Digital experience
• Public safety & security
• Eco & sustainability
Fujisawa SST
Japan
• 47 acres
• Opened spring 2014
• Single-family homes, condos/townhomes, multigenerational living
• 600+ families

-70%
-30%
30%
+25%
Mayoral Proclamation

• Issued by Michael Hancock, Mayor City and Country of Denver
• Acknowledged by Joseph Taylor, Chairman Panasonic Corp. of N.A.
• Signed 6/3/2015
• Proclamation defines;
  ✓ 4 pillars and establishment of task forces
    → Evolved to 5 pillars (see below)
  ✓ the goal of the task forces to find technological and innovative solutions to key priorities and challenges in respective pillars.
    → 18 specific projects for the 4 pillars
Peña Station NEXT
Denver, CO

- 382-acre transit-oriented development
- Opened September 2016

Solutions include:
- Solar+storage microgrid
- Smart streets network
- Smart parking
- V2X
- EV charging
- Community WiFi
Peña Station NEXT
Denver, CO

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Solutions include:
- Solar+storage microgrid
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- Smart parking
- V2X
- EV charging
- Community WiFi
Pillar Process

Aligns key stakeholders
- With greatly varying needs & resources
- Supplements existing processes

Ensures Integrated Service Design
- Across diverse organizations
- To achieve maximum transformation

Provides prioritized project pipeline
- Generates & vests many opportunities
- Maps investments to specific objectives

Denver Executive Steering Committee
- Mayor Michael B. Hancock
- Alan Salazar, Chief of Staff
- Jim Doyle, President PESCO
- Jarrett Wendt, EVP PESCO

Denver Pillar Structure
Xcel Energy’s First Microgrid in CO

2017 Environmental Leader Top Project of the Year Award

2017 Energy Storage North America Innovation Award Finalist

Portfolio of Benefits

• Solar PV Grid Integration (Ramp Rate, Bulk Shift)
• Grid Peak Demand Reduction (Demand Response)
• Frequency Response
• Energy Arbitrage
• Backup Power Resilience
Smart Streets: Lighting the Way to Smart Cities
Carbon-Neutral Energy Planning with NREL
Autonomous Electric Shuttles
Solving first/last-mile problems

- 6 seats / 12 passengers
- ~14 hours battery without AC
- ~7 hours battery with AC
- 15 mph transit speed (25 mph top speed)
WHEREAS, the Colorado Department of Transportation has launched the Road X program to use technology and ingenuity to solve infrastructure challenges; and

WHEREAS, Colorado is spearheading innovation by launching a first-of-its-kind effort to build a connected vehicle program with Panasonic in which real-time data will be shared across vehicles, infrastructure, and people to improve safety and mobility on the road; and

WHEREAS, Colorado has been a thought leader by advocating proactive legislation to promote connected and autonomous transportation systems while balancing public safety concerns; and

WHEREAS, human error contributes to most crashes and the deployment of connected and autonomous driving systems can reduce fatalities, provide increased options for mobility-challenged residents, and reduce congestion and impacts to the environment; and

WHEREAS, Easymile, a leader in driverless technology, has announced its North American headquarters in Colorado, and is co-locating their facilities with Panasonic – an international trailblazer in developing smart and sustainable automotive and infrastructure technology solutions; and

WHEREAS, today marks the inaugural demonstration of an autonomous shuttle on city streets, connecting Tower Road to Pano Station, and offering a practical application of first and last mile connections with existing public transit systems; and

WHEREAS, Colorado’s reputation as a hub for advanced technologies continues to grow and, with Panasonic and Easymile as anchors in this sector, allows for the recruitment and development of additional transportation innovators with the goal of creating a mobility center of excellence;

Therefore, I, John P. Hickenlooper, Governor of the State of Colorado, do hereby proclaim, December 4, 2017, as

AUTONOMOUS AND CONNECTED VEHICLE DAY
in the State of Colorado.

Given under my hand and the
Executive Seal of the State of
Colorado, this fourth day of
December, 2017.

[Signature]
John Hickenlooper
Governor
Colorado-Panasonic Partnership

Five (5) years, $72 Million V2X Deployment Program

1. V2X TOC Data Platform

2. Open Access Framework

3. Production-Grade Deployment on Active, Open Roadways

Launched Jan 2017

Launching 2018
Panasonic Automotive Customers
Panasonic Automotive Achievements

Largest Global OEM Systems Integrator

- Global Display Audio
- Infotainment
- Navigation
- EV Battery
- Instrument Panel
- Sensor/Safety
- Connectivity
- ADAS (Advanced Driver Assistance Systems)
- V2X

Industry Awards

- IHS #1 Global Display Audio Supplier
- IHS #1 NA Infotainment Supplier
- IHS #3 Global Navigation Supplier
- LUX Research #1 Global Battery Supplier

Customer Awards

- 2015 GM Supplier of the Year
- 2015 FCA Electrical Supplier Qualitas Award
- 2016 Honda Innovation, Value and QDV Awards
- 2014 Toyota Global Contribution Award
- 2015 Lexus Executive Partnership Award
- 2016 Ford World Excellence Green Brand Pillar Award
Panasonic V2X Opportunity Space

V2X Technology

Panasonic

Customers

Traditional Tier OEM Suppliers

Competitors

Suppliers

CONFIDENTIAL
CDOT-Panasonic V2X Deployment

Phased Deployment Approach

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<td>• Develop Phase 0 Baseline Schedule</td>
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<td>• Define &amp; Initiate Program Management</td>
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<td>• Complete Systems Engineering Planning</td>
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<td>• Select Project Vendors &amp; Partners</td>
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<td>• Develop Phase 1-5 Preliminary Schedule</td>
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Agile, Iterative Delivery

CDOT Live Environment

CDOT Pilot Sites

Panasonic V2X Test Environment (Lab, Garage, Roadways)
Phase 1 Scope

Phase 0 / Task Order 1
Program Planning

Phase 1 / Task Order 2
Vehicle-to-Infrastructure (V2I)

Install equipment in vehicles
Install equipment along I-70
Collect, transfer, store, and visualize data from vehicles

Phase 2 / Task Order 3
Infrastructure-to-Vehicle (I2V)

Phase 3 / Task Order 4
Vehicle-to-Vehicle (V2V)

Phase 4 / Task Order 5
Enhanced Data Analytics

Phase 5 / Task Order 6
End-to-End Deployment
1. On-Board Equipment (OBE) – V2X equipment inside vehicles that transmits and receives data between vehicles and to the infrastructure.

2. Roadside Equipment (RSE) – V2X equipment installed on the infrastructure that transmits and receives data to and from vehicles.

3. V2X Data Ecosystem (VDE) – V2X Data Environment and Open Development Platform.
Panasonic V2X Test Environment

- **Rapid Prototyping**
  - DSRC deployment delivered in less than 6 months (Feb-Aug 2017)

- **Quick Stakeholder wins**
  - CO Transportation Commission approval to proceed from Phase 0 ($7.5M) to full contract ($72M)

- **Now Trusted as Proving Ground for Scale**

**Indoor lab & garage V2X test environments**
- Five (5) OEM test vehicles
- Hardware- & software-in-the-loop testing
- Complete V2X data simulation

**Outdoor V2X test environment on controlled roadways**
- Total of six (6) V2X roadside units for 100%
- Fiber backhaul communication with redundant ring design & managed network devices.
- Dedicated power to accessible, roadside utility cabinets.
C-V2X: Incremental Growth towards Scale in Colorado

- CDOT Live Environment

I-70 Mountain Corridor + 400 additional miles
- 90 miles equipped in 2018
- 300 CDOT fleet vehicles equipped in 2018
- Funding for equipment upgrades/replacements through 2021
- High visibility, high impact corridor
- Steep grades, sharp curves, tunnels, and extremes winter weather conditions
Intergalactic Mobility Center of Excellence
Creating a Platform for Smart Mobility

1. Create a multi-modal “Smart Mobility” Center
   - Leverage Pena Station Next as foundation
   - Extend to 4 corners of Colorado
   - Cover Planes, Trains, Buses, private and commercial automotive, etc.

2. Leverage progressive public mobility entities in Colorado
   - CDOT | DEN | RTD
   - Commercial Rail
   - Commercial Logistics

3. Launch an incubator for the future of US mobility
   - Create a collaborative environment where public, large commercial and start-ups can work to define the future of US mobility
   - Leverage skilled incubator company
   - Invite other US Federal, State and Local agencies