Welcome to

Advanced Textiles
EXPO

ORGANIZED BY ATA

Inteva at a Glance

100+
Customers

Inteva has a true global presence and reach, with engineering and production capabilities across the Americas, Asia and Europe.

30
Global Sites

From our headquarters in Troy - Michigan, we operate 30 global facilities.

9000+
Employees

Our global team shares one common vision: ensuring that customers and partners recognize Inteva as a global leading company in innovation, sustainability, and products that enhance the consumer experience.
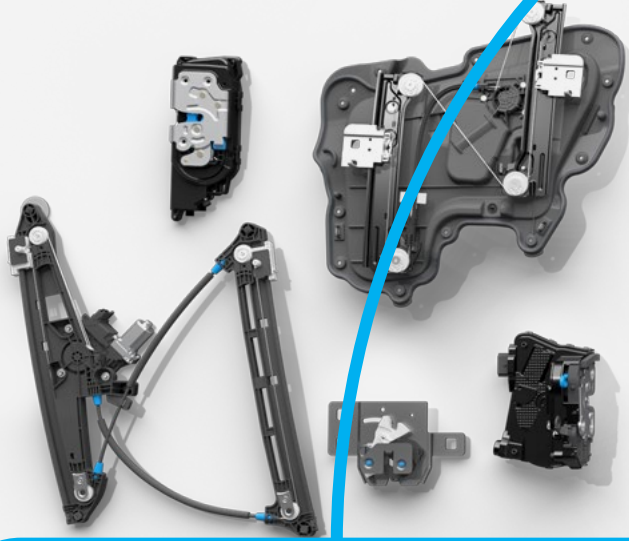
3
Areas of Excellence

Inteva combines a culture of continuous improvement with our advanced expertise in Interior Systems, Closure Systems, and Motors & Electronics to provide world-class solutions to customer needs.

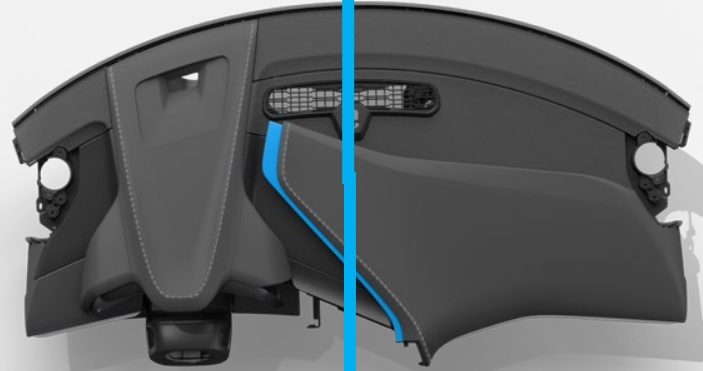**Jeremy Husic**| Staff Engineer| Oct. 31, 2023

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Products

Smart Surfaces

Closure Systems

- Latching Systems
- Window Regulators
- Door Modules
- Smart Actuators
- Smooth Motion Systems
- Actuators and Strikers (KDS JV)

Interior Systems

- Instrument Panels, Door Trim, Floor Consoles
- Cockpit Assembly
- Inteather™ Materials
- InStitch™ Technology
- Smart Soft Surfaces
- Electronics for Touch Sensing and Lighting
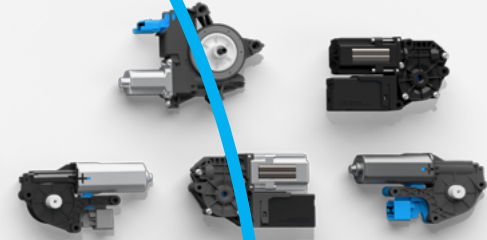
Motors & Electronics

- Window Motors
- Sunroof Motors
- Electronics

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Challenges of Smart Surfaces in Automotive Trim
Abstract

Smart surface technology enables *functional features* in areas that were once just decorative automotive trim. Portions of the **lighting and electronics are embedded** into the trim layers, while others are packaged behind the substrate. Allocating the electronics in this new space has created a need for new business relationships. **Technical challenges** include material compatibility for bonding methods, appearance, **softness,** distinction of image, touch sensitivity, hidden front functionality, packaging space, connection and others.*

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Topics

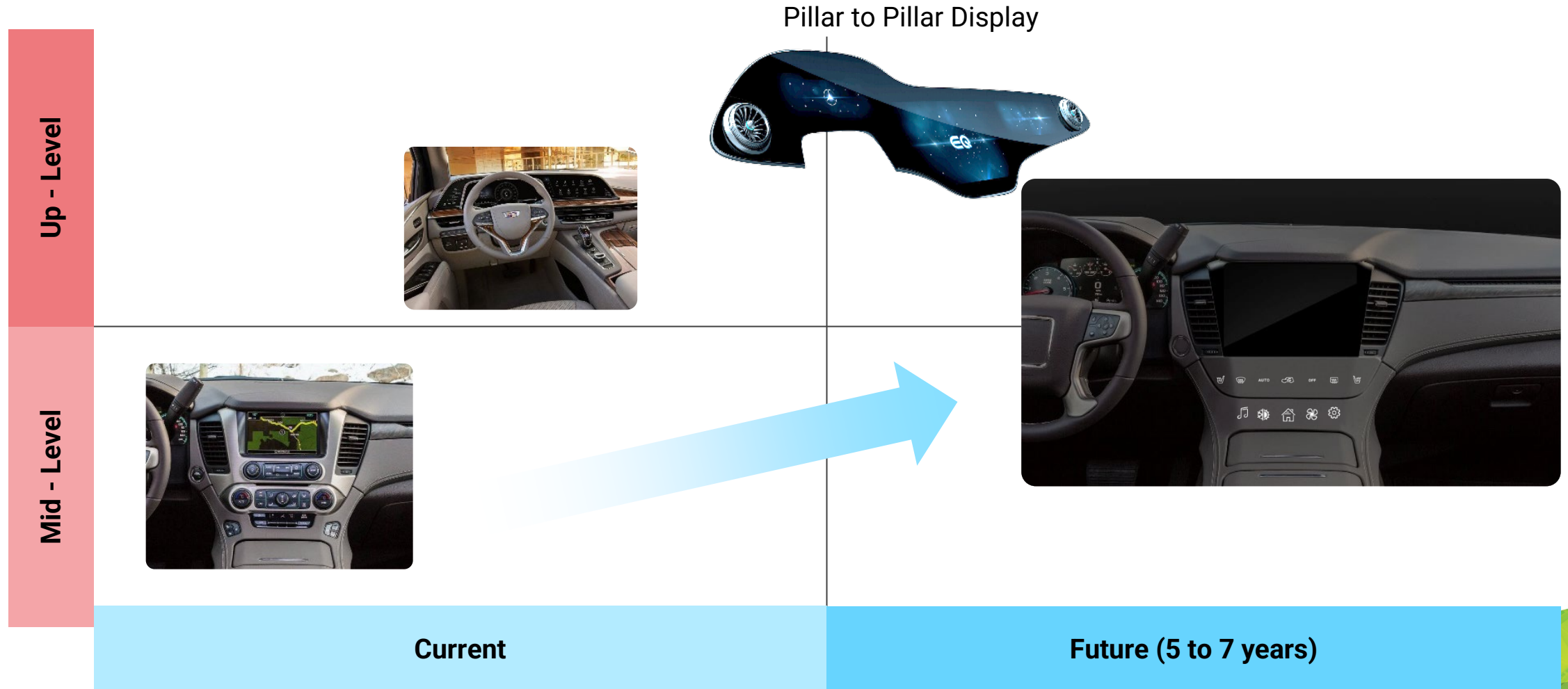| Examine Trends | Brainstorm | Develop Concepts | Studio Ideation | Base Design | Proof of Concepts | Evaluation |

- Why soft smart surfaces?

- Smart surface opportunities

    - Market considerations

    - New locations with the potential for improved ergonomics

    - HMI functionality that maintains soft feel

    - New constructions

- Development and approach to smart surface applications

- Challenges

- Examples

- Summary

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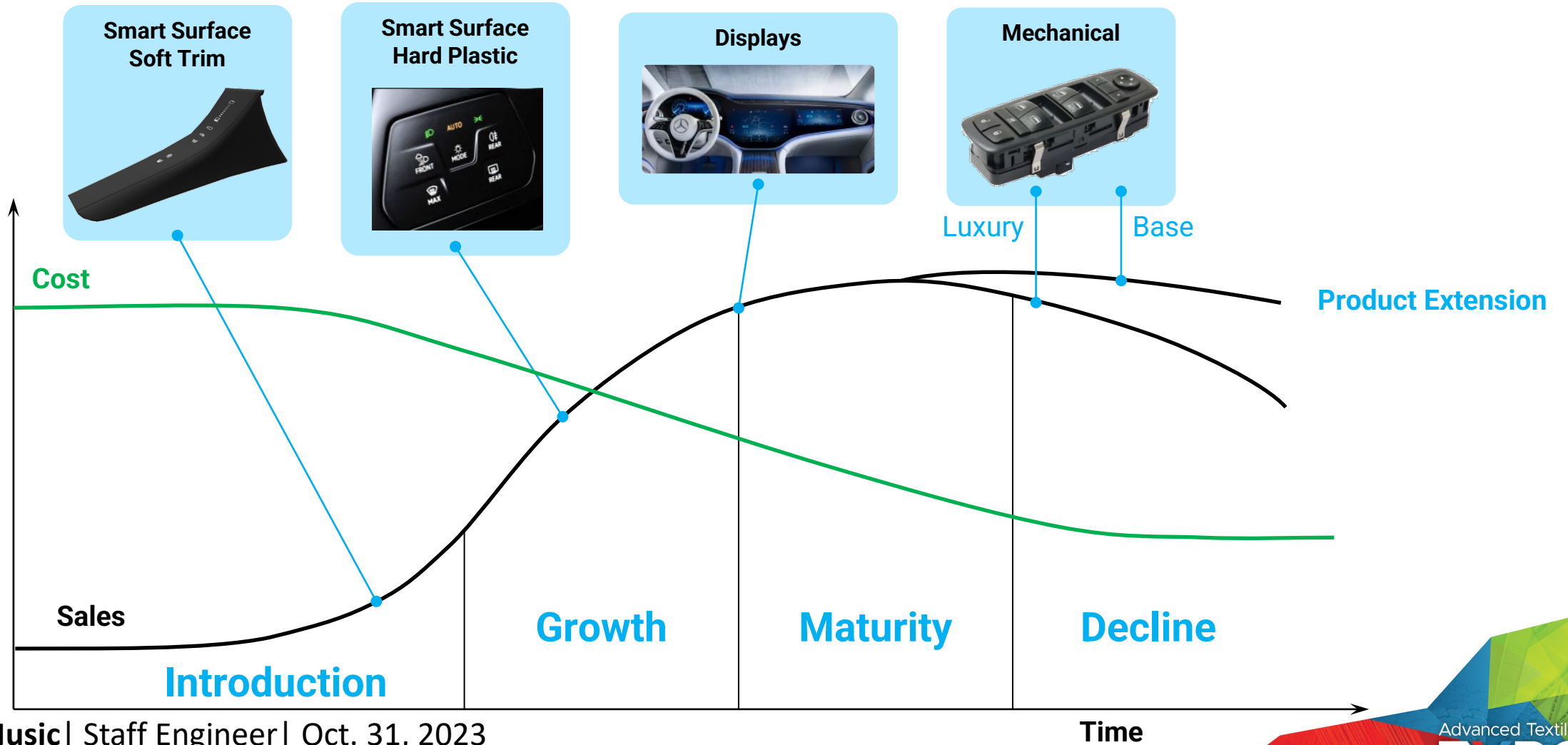
Why Soft Smart Surfaces?

- Through multiple avenues there is growing possibilities for smart automotive surfaces overall

- A focus has been in the soft smart surface area for several reasons
    - Interior systems integrators already have expertise in soft trim
    - Some integrators have capabilities in electronics
    - Inteva provides roll good products through our Inteather™ line of TPO products
    - Inteva's capabilities make moving toward soft smart surfaces to be a natural progression

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Market Segmentation vs. Time

Pillar to Pillar Display

Up - Level

Mid - Level

Current

Future (5 to 7 years)

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Interior Switch Product Cycle

Display vs. Soft Smart Surfaces

Displays

Pros
- Re-programmable
- Haptics
- Streaming Content (Fee Based)
- High Switch Density
- Customizable
- Wide Range of Gestures
- Highly Visual Feedback

Cons
- Hard Surface
- Mainly Flat or little Contour
- Multi-layered Menus
- Flat Look Not Matching Trim
- Glare/Reflections
- Hard Surface in Crash
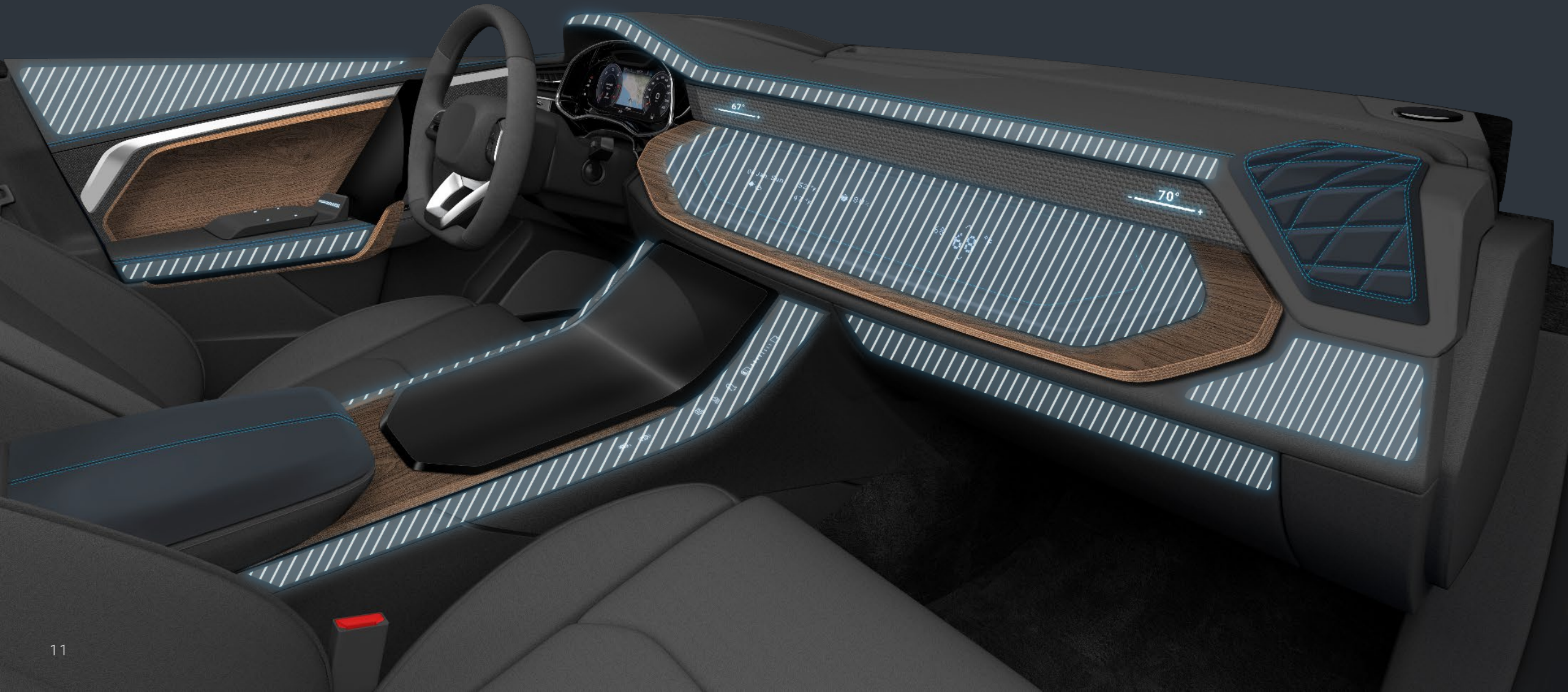- More Distractions

Smart Surfaces

Pros
- Match Interior Harmony
- Soft is Possible
- Ergonomics
- Fixed Locations
- Hidden Switches
- 3D Contour
- Reduced Distractions
- Improved Packaging
- Anywhere in Vehicle (low Z depth)
- Bridges Gap from Traditional to Displays

Cons
- Lower Switch Density
- Constrained to Available Area
- Each Design Unique
- Technology Needs Development
- No Interactive Content

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Potential Locations

General Customer Requirements

Product Feel

| Hard | Semi Hard | Soft | Very Soft |

Skin Materials

| Leather | TPO | PU | PVC | Hard MIC |

● *Area of Focus*

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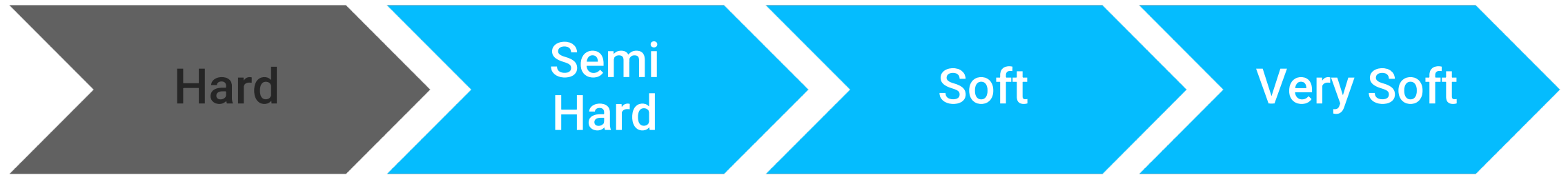
Smart Soft Surface Constructions

Wrap Over Hard	Cut-Sew-Wrap	Applied Skin

Integration

Switches
Hard Printed
Circuit Board

Icons
Perforations

Integration

Switches
Stretchable

Icons
Embossed

Integration

Switches
Hard Printed
Circuit Board

Icons
Translucent
TPO

Integration

Switches
B-Side Film

Icons
Perforations

Integration

Switches
Stretchable

Icons
Translucent
TPO

Integration

Switches
Hard Printed
Circuit Board

Icons
Translucent
Polyurethane

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Specialty Materials and Processes

Perforation & Stitching	Specialty Fabric Applications	Hidden Front TPOs

Integration
- Illumination Through Perforations
- Illuminated Stitch
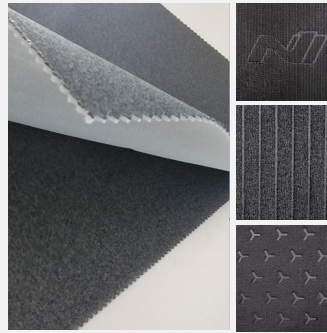
Integration
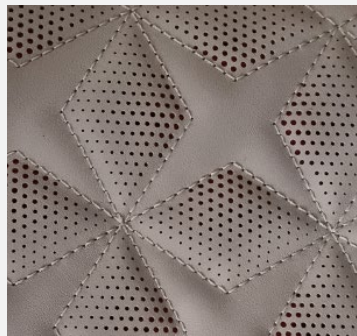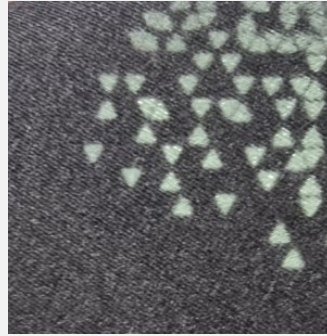- Embossed / Debossed Fabric for Back Lighting Applications

Integration
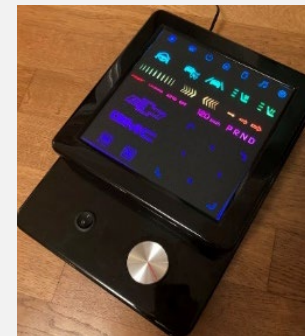- First Surface Printed Icons with Hidden Front

Integration
- Geometric Patterned Perforations

Integration
- Back Printed Fabric for Lighting and HMI

Integration
- Second Surface Printed Icons with Hidden Front

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Full Concept Properties

Multiple Function Demonstrators

Features

- Wall UI
- Integrated Track Pad
- Force Sensing Window Control
- Illuminated Stitch With Touch Slider

Features

- Illuminated Stitching with Back Lighting
- Welcome Mode
- Safety Alerts
- Convenience Alerts
- Animated Lighting

Features

- Touch Screen
- Express Anywhere
- Rearview Camera
- Touch Open Switch
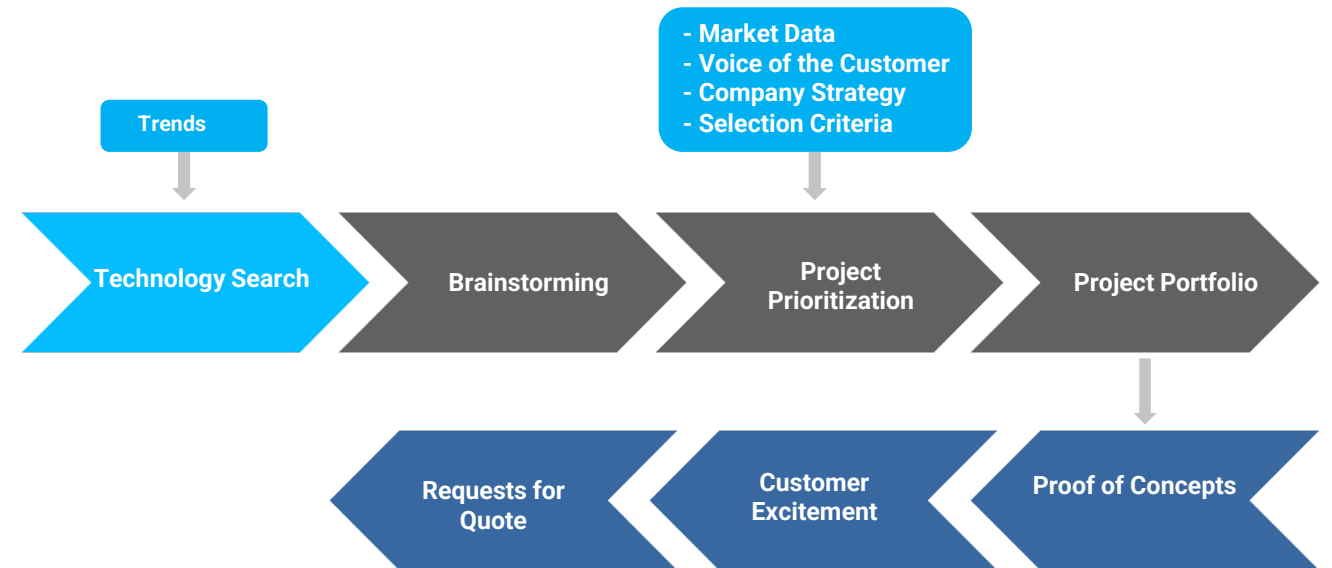- Illuminated Welting

In Development

Features

- Smart Window Switch
- Heated Surface
- Illuminated Stitching & Perforation
- Large Area Lighting
- Hidden Front TPO

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Development Process

- Look at the industry trends
  - Conferences, expositions, auto shows, etc.
  - Direct OEM discussions
- Build on this information to extrapolate customer and system requirements
- Develop concepts that best fit our capabilities
  - Brainstorming
  - Studio activities
- Build high quality proof of concept parts
- Performance is evaluated
- Parts are tested
- We use this data to further refine the design

Trends

- Market Data
- Voice of the Customer
- Company Strategy
- Selection Criteria

Technology Search → Brainstorming → Project Prioritization → Project Portfolio

Requests for Quote ← Customer Excitement ← Proof of Concepts

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Smart Surface Application

Applications can require each of these elements

Clear function – Intention
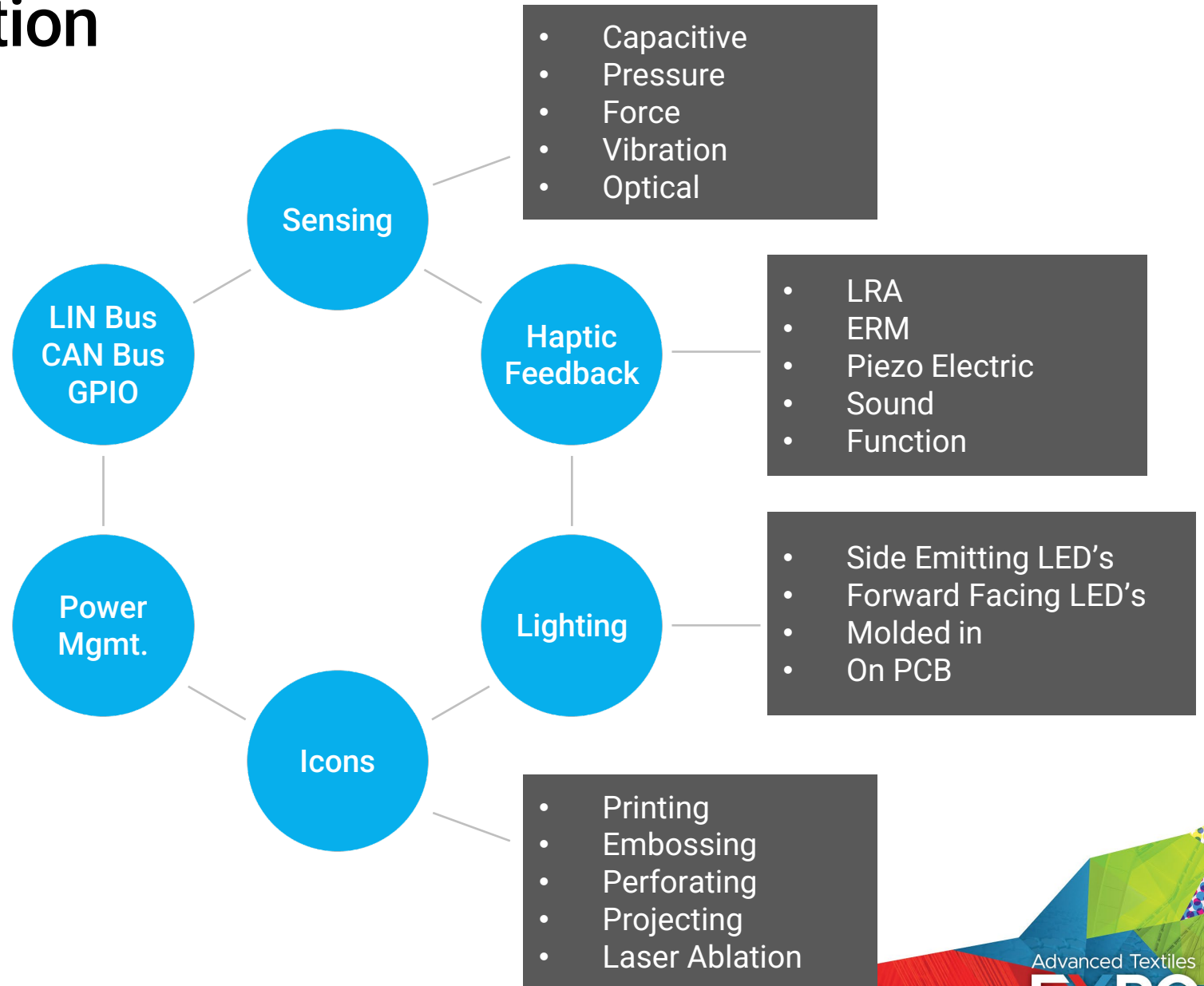- Intuitive Interaction – UX / HMI
- Icons & Lighting

Feedback
- Did it work?
- Haptics and Lighting

Communication
- Indicate a selection event

Power

Sensing
- Capacitive
- Pressure
- Force
- Vibration
- Optical

Haptic Feedback
- LRA
- ERM
- Piezo Electric
- Sound
- Function

Lighting
- Side Emitting LED's
- Forward Facing LED's
- Molded in
- On PCB

Icons
- Printing
- Embossing
- Perforating
- Projecting
- Laser Ablation

Power Mgmt.

LIN Bus CAN Bus GPIO

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Smart Surfaces to Production

Tier 1

Partner

In-House Competencies

Materials

Lighting & Electronics

Packaging Evaluation
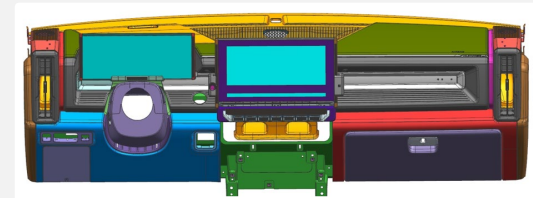
Concept Development
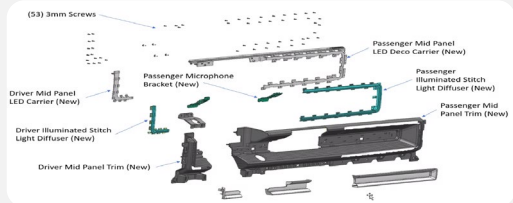
Industrialization
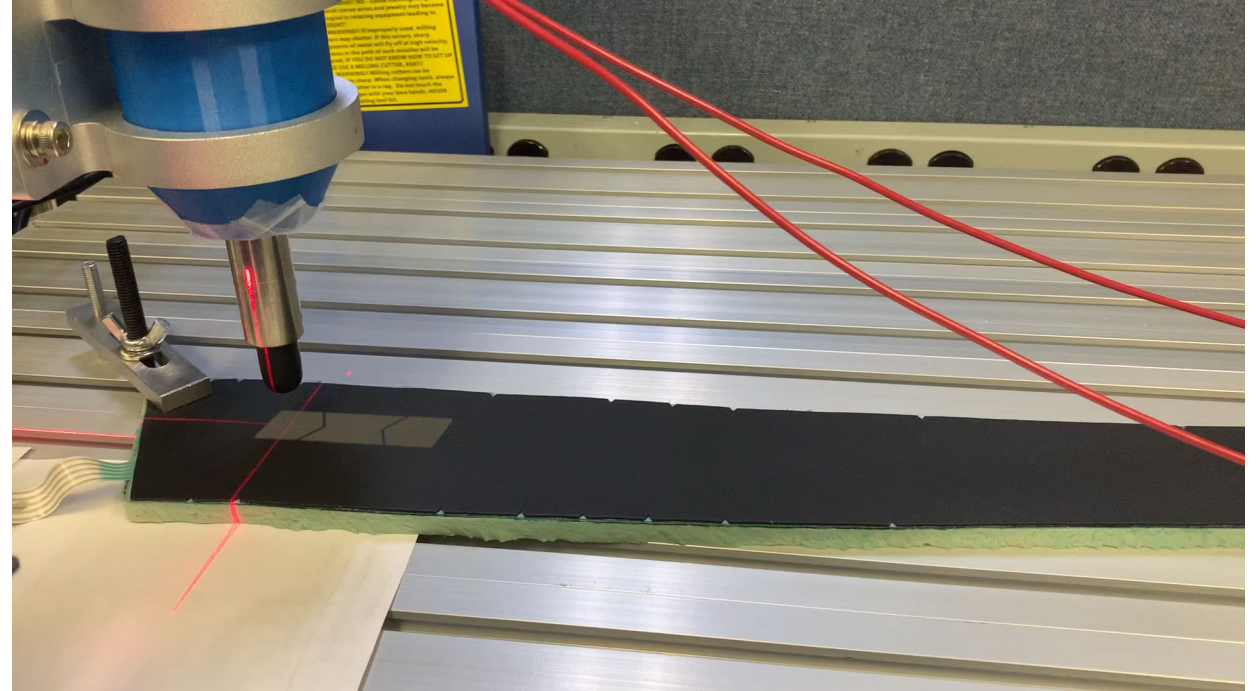
Production

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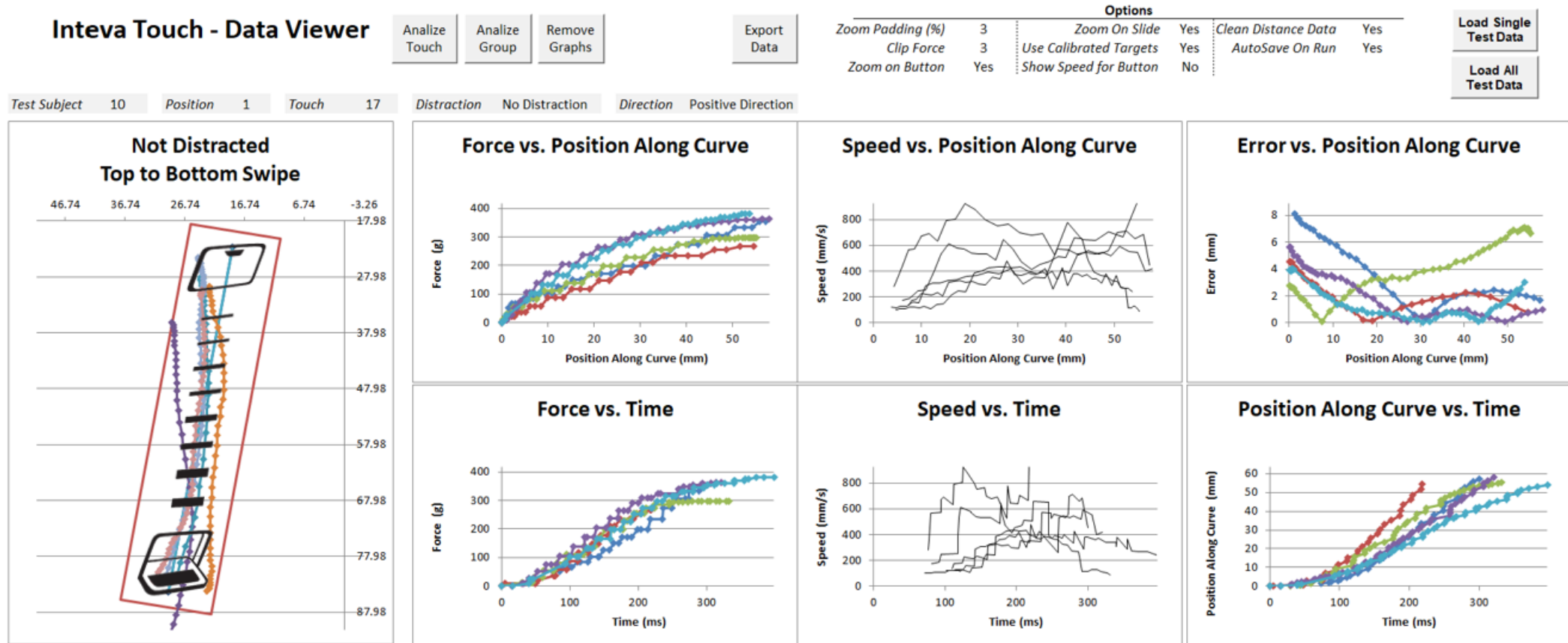
HMI Evaluation

Screenshot of Touch Data Viewer Excel Sheet

Machine Based Sensor Evaluation

- Simulation Gesture Swipe From Ergonomic Study
  - Pressure
  - Position
  - Speed
- Provides Variable Data For Capability Studies
- Improves Sensor Design

Challenges

- Packaging
    - Introducing Electronics Into New Locations
    - Managing PCB Locations And Connections
- Understanding Customer Requirements
- Using All New Materials And Processes
- Maintaining A Thin, Flexible Design
    - Balancing Light Output And Thickness
    - Cut – Sew – Wrap Capability
- Maintaining Softness
- Providing Icons With High Distinction Of Image
- Verifying Good HMI Ergonomics
- Unique Challenges To Locating An HMI Where It Isn't Normally Found
    - Designing For Unintended Interaction
- Commercialization
- Keeping Pace With Trends – Especially Rigid Displays
    (Size & Quantity) – Assuring That Interest Isn't Shifting

Unintended Actuators

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Smart Door Trim

7) Strähle & Hess Material
- Sustainable Flat Knit Material

1) Wall UI – LED Matrix
- Dynamic Surface Backlighting
- Capacitive Touch
- Display Controls
- Hidden Front Fabric
- Hexagonal LED Spots with glow effect
- Alert & Welcome function

6) PWS – Power Window Switch
- Hidden Front PWS Icons
- Illuminated Icons
- Touch Pad Display Controls
- Haptic Feedback for Window Controls
- 4 Segments Digital Watch

2) Illuminated Stitch
- Thread Illumination
- Capacitive Swipe function
- Alert & Welcome Function
- Change Temperature
- Change Ambient Light Scene

5) Mobile Phone Storage Box
- Capacitive charging
- Mobile Phone hidden in Door Panel
- Simple Push Push Mechanism

3) Map Pocket Illumination
- Edge Ambient Light diffuse insight Light

4) Alternative Switch
- Capacitive Button
- Leather Cladded

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Perforated & Stitched Decor Materials

Multifunctional Sewing Process

- Automatic, computer-controlled multifunction machine for sewing, embroidering and perforation
- Excellent repeatability & position accuracy
- Integration of switch/touch function

At a Glance
- Different material combinations
- Combination with illuminated thread
- Flexibility, no further or additional machines/operations for perforation or embroidery

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Specialty Fabric

Made in a one-step circular knitting process

- Fabric BACKLIT (backlight function only)
- Fabric ICONS (backlight of Icons)
- Fabric TOUCH (touch control & backlight)
- Fabric DESIGN LOGO (visual icon indication on surfaces)

At a Glance

- High transmission levels, up to 30%
- Very good material properties, tested according to the most critical OEM specifications
- Cost efficient, low weight material

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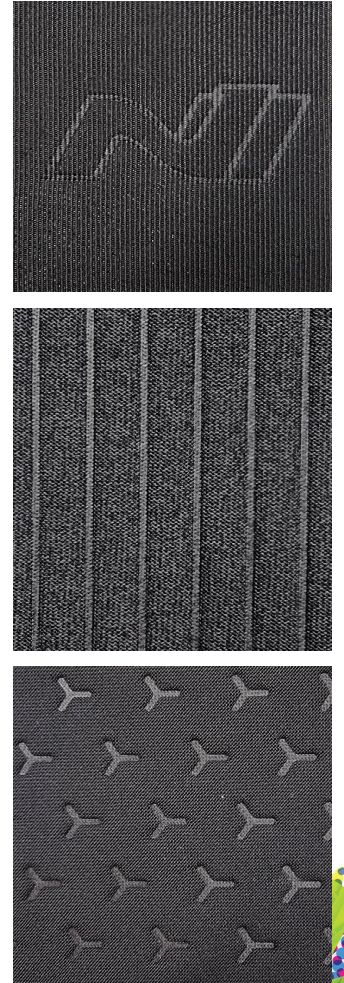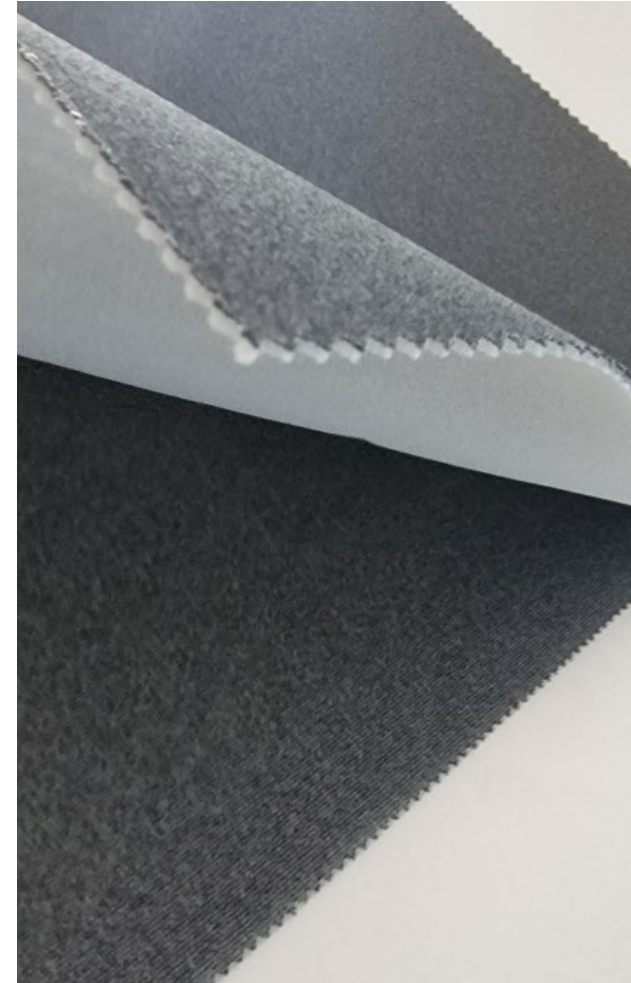
Hidden Front TPO

Hidden Front Decor materials

- A thin, proprietary TPO that uses unique printing materials and methods to provide clear, sharp icons with hidden front functionality.

Several TPO offerings that provide hidden front functionality

- Clear TPO
    - 1st surface printed
    - 2nd surface printed
- Integral hidden front TPO

At a Glance
- High precision graphics
- Cut sew wrap offerings
- Thermoformed bi-laminate offerings
- Accommodates multiple levels of softness
- Application of artificial leather materials in CSW process
- Static or dynamic light animation of the surfaces

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Alternative Switch

Leather wrapped capacitive switch

- Wrap Over Hard construction
- Fits a current production vehicle as a potential drop in replacement
- Capacitive Sensing Through Leather

At a Glance
- E-unlatch, lock & unlock functions
- LIN communications
- E-unlatch is full RGB
- Simple LED animations
- Package protected for haptic feedback
- Icon element shown round but do not have to be
- Excellent color match
- Very good viewing angles
- Packaging neutral to original

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Debossed Leather Sensor Element

Debossed Leather Construction Over PU Foam

- Full Soft Trim Level

- Gesture Control Of Glove Box Opening

- Capacitive Sensing Through Leather

At a Glance
- Example for glove box a power open / close
- Stretchable construction
- Embossed genuine leather
- Standard Cut & Sew compatibility
- Unlimited foam below first surface
- 3 Sensor elements for gesture control
- Opening and closing glove box
- Gloved hand and water tolerance design
- 1.4mm thick (or less)

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Glove Box Video

Soft Surface HMI

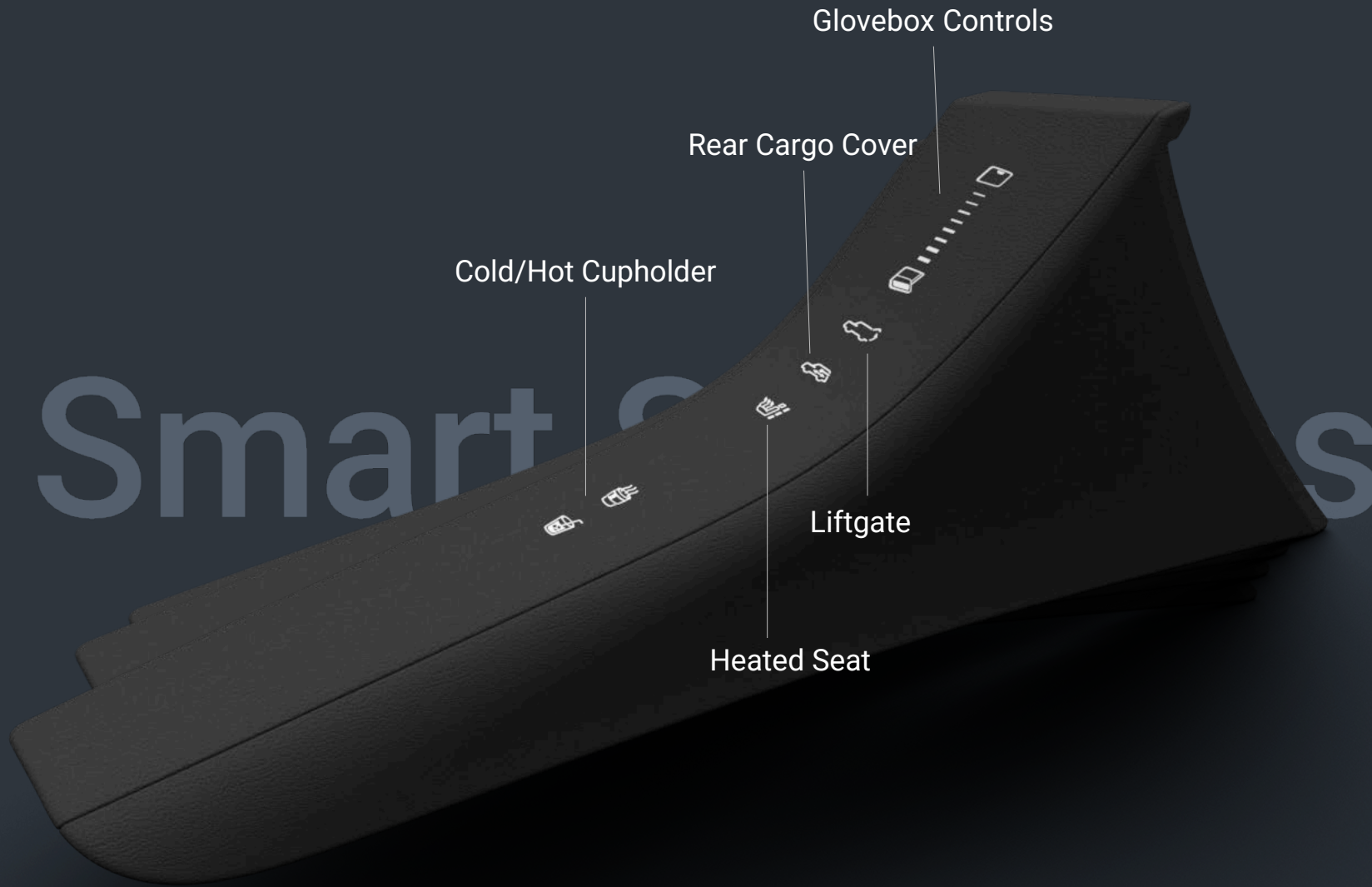**Hidden Front TPO Construction**

- Icons Appear With Proximity
- Full Soft Feel
- Capacitive Sensing With Back Lighting
  - Function for: Liftgate, Cargo Cover, Heated Seats, And Cup Heating / Cooling

At a Glance
- Hidden Front TPO
- Stretchable construction
- 26 LED's – 9 Groups – 4 Colors
- Simple LED animations
- 600 – 700 cd/m²
- 10 Sensor Element – 2 Sliders – 4 Discrete
- LIN capable
- 9 GPIO
- 1.7mm Thick
- Haptic feedback capable

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Glovebox Controls

Rear Cargo Cover

Cold/Hot Cupholder

Liftgate

Heated Seat

Smart Seats

Soft Surface HMI
Construction

Hidden Front TPO Component

Silicone Over-Mold

LED Sub Assembly

Sensor Element

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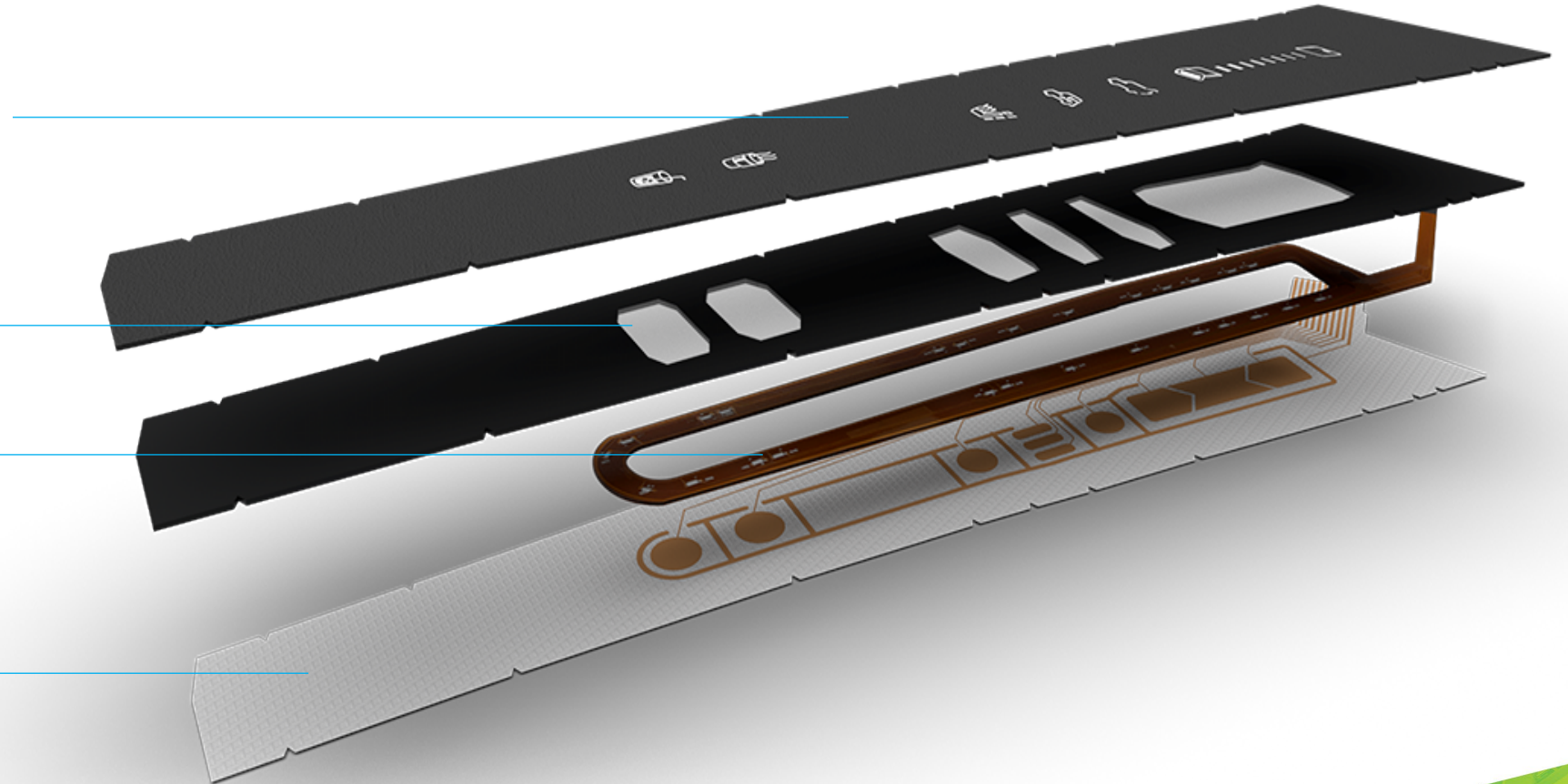
Smart Window Switch

Description

- Window location control pod with input feedback
- Express Anywhere
    - Eliminates frustration with express up-down systems

At a Glance
- Full leather wrap
- Protected wake up
- Express "Anywhere" Functionality
- LIN communications
- Haptic feedback
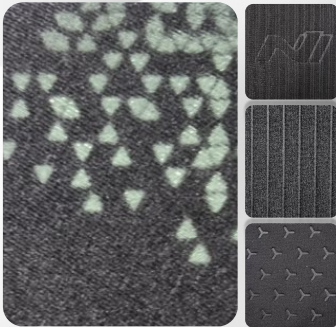- Micro LED visual feedback
- High brightness design

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Floor Console
Smart Soft Surfaces Integration

Hidden Front (1st / 2nd Surface Printing)

Back Illumination Through Perforation / Fabric

Printed Icons with Hidden Front

OLED Display Integration

Crystal Jewel

Illuminated Stitching

Illumination Through Perforation

Back Printed Fabric for Lighting and HMI

Speaker-Through Fabric

Smart Window Switches

Heated Surfaces

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Floor Console
Interiors, Closures, Motors and Electronics Integration

Sliding Cupholders

Deployable Console Table

Deployable Phone Storage with Wireless Charging

Sliding Upper Console

Pop-out Control Pad

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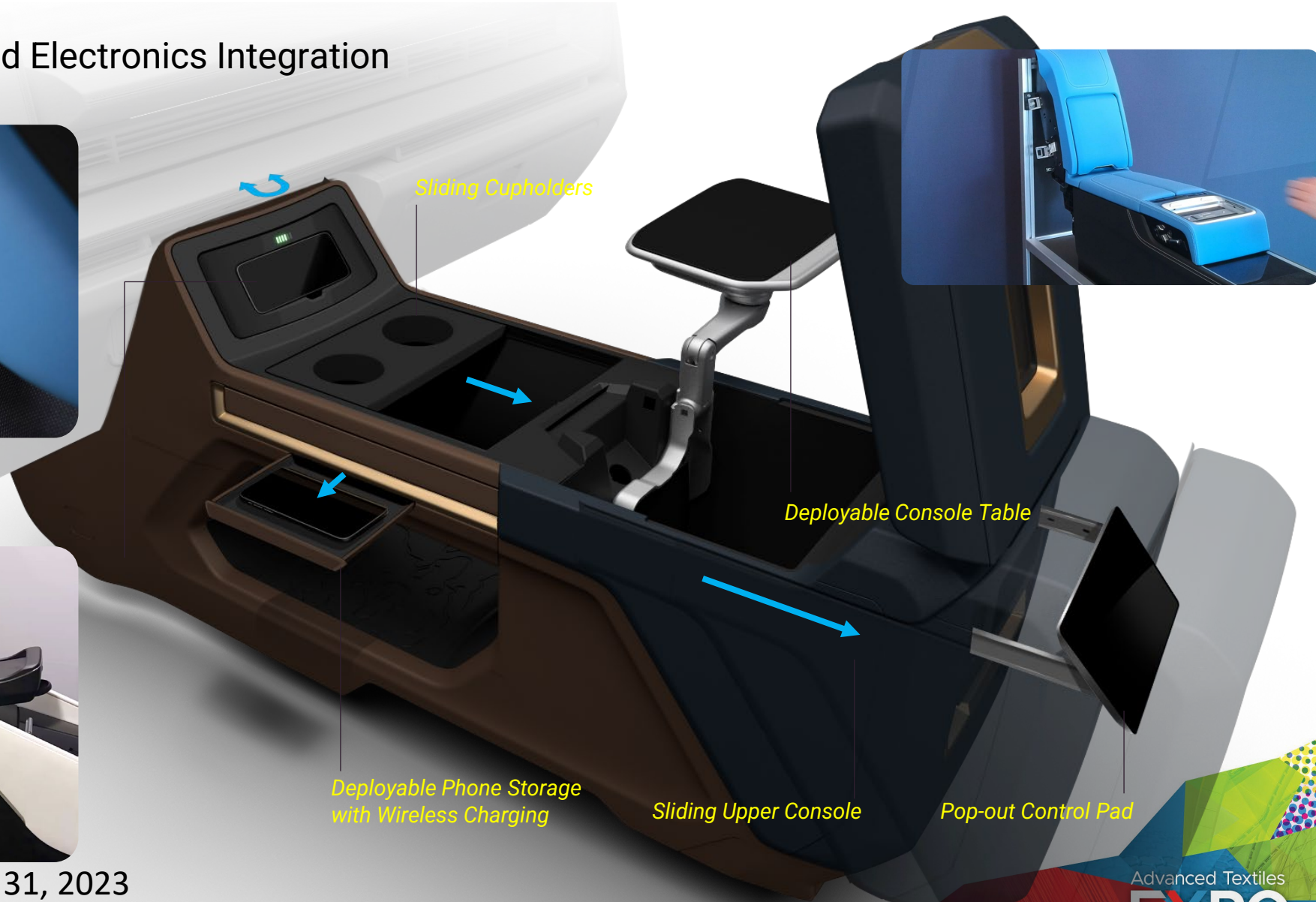
Summary

- Continue to Look At Trends And Other Industry Drivers

- Continue To Develop A Portfolio Of Product Offerings

  - Various Softness And Constructions

  - Unique HMI Designs

- Continue To Advance The Technology

  - High Quality Proof Of Concept Parts

  - Detailed Assessment And Testing

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Thank You