THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

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OVERVIEW

THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

THE ERGONOMIC CARRY SYSTEM

GOAL: Create a wearable load-transfer system that adapts to rider posture and improves stability, comfort, and control during urban e-bike commuting.

PROBLEM: Conventional backpacks move away from the rider's center of mass during forward-leaning riding posture, increasing sway, fatigue, and dynamic instability.

PROPOSED SOLUTION: An engineered harness and guided-load architecture that lowers and pulls the carried mass inward as the rider leans forward, improving load alignment and riding stability.

Type	User	Context	Status
Wearable Load-Transfer System	Urban E-bike Commuters	Daily Mobility	Validated Prototype

PROBLEM DEFINITION

WHY CONVENTIONAL BACKPACKS FAIL E-BIKE COMMUTERS

E-bike commuting is growing as cities get denser and travel times rise. Yet the gear we carry wasn't designed for the way we actually ride. Conventional backpacks shift the load away from the body's center of mass, creating leverage, instability, and fatigue, especially in a forward-leaning posture.

THE CORE ISSUE

The load sits too far from the body's centerline and moves on an uncontrolled arc as the rider changes posture. This increases moment arm, causes sway, and forces the body to work harder to stay balanced and stable.

01 WHO THE COMMUTER IS

Urban e-bike commuters are efficiency driven, time constrained, and carry daily essentials for work and life. They ride in varying conditions and need comfort, control, and confidence, every day.

THE MODE
E-bikes extend range and speed, encouraging forward-leaning riding postures.

THE LOAD
Laptops, tools, chargers, clothing, and daily essentials.
Typical **carry range: 6–12 kg***

THE CONTEXT
Stop-and-go traffic, varied terrain, long durations, and frequent acceleration.

THE NEED
A carry system that adapts to the rider, reduces fatigue, and keeps the load stable and aligned.

02 WHY RIDING POSTURE IS THE PROBLEM

When a rider leans forward, the torso rotates but the backpack lags behind. This creates a longer moment arm (hip to COM) and pulls the load backward and outward—exactly where it hurts most.

CONVENTIONAL PACK (WHAT GOES WRONG)

UPRIGHT / WALKING	FORWARD RIDING LEAN

UPRIGHT / WALKING	FORWARD RIDING LEAN
• Load close to the spine • Shorter moment arm • Lower stress and sway	• Load shifts backward and outward • Longer moment arm (hip to COM) • Increased sway, strain, and fatigue

BIOMECHANICAL PENALTIES (FORWARD LEAN)

LONGER MOMENT ARM	INCREASED SWAY	HIGHER MUSCLE LOAD	FASTER FATIGUE
More torque on the lower back and hips	Greater lateral movement and instability	More effort to control balance and posture	Reduced endurance and ride quality

03 WHY CONVENTIONAL PACKS FALL SHORT

Traditional backpacks are built for static or walking use. They don't account for the dynamic, leaned-forward posture of e-bike riding.

NO CONTROLLED LOAD PATH
The load moves on an uncontrolled arc as the torso leans, increasing moment arm and strain.

EXCESSIVE BACKWARD SHIFT
Weight pulls away from the body's centerline, reducing balance and control—especially at speed.

INCREASED SWAY
The load swings laterally with every lean, brake, and turn—causing instability and mental fatigue.

POOR PRESSURE DISTRIBUTION
More load on shoulders and upper back, less support at the hips. Pressure points lead to discomfort and fatigue.

BUILT FOR WALKING, NOT RIDING
Conventional packs don't adapt to the rider's posture or movement. The rider has to adapt to the pack.

DESIGN OPPORTUNITY		ALIGN WITH THE BODY	MOVE WITH INTENT	REDUCE STRAIN	RIDE BETTER
	Create a system that moves the load downward and inward as the rider leans, keeping the center of mass close, reducing moment arm, minimizing sway, and improving comfort, control, and efficiency.	Keep the load close to the spine in every posture.	Engineer a guided path for the load.	Shorter moment arm. Less effort. Less fatigue.	More stability, confidence, and endurance.

02

REASONING & VALIDATION

THE ERGONOMIC CARRY SYSTEM

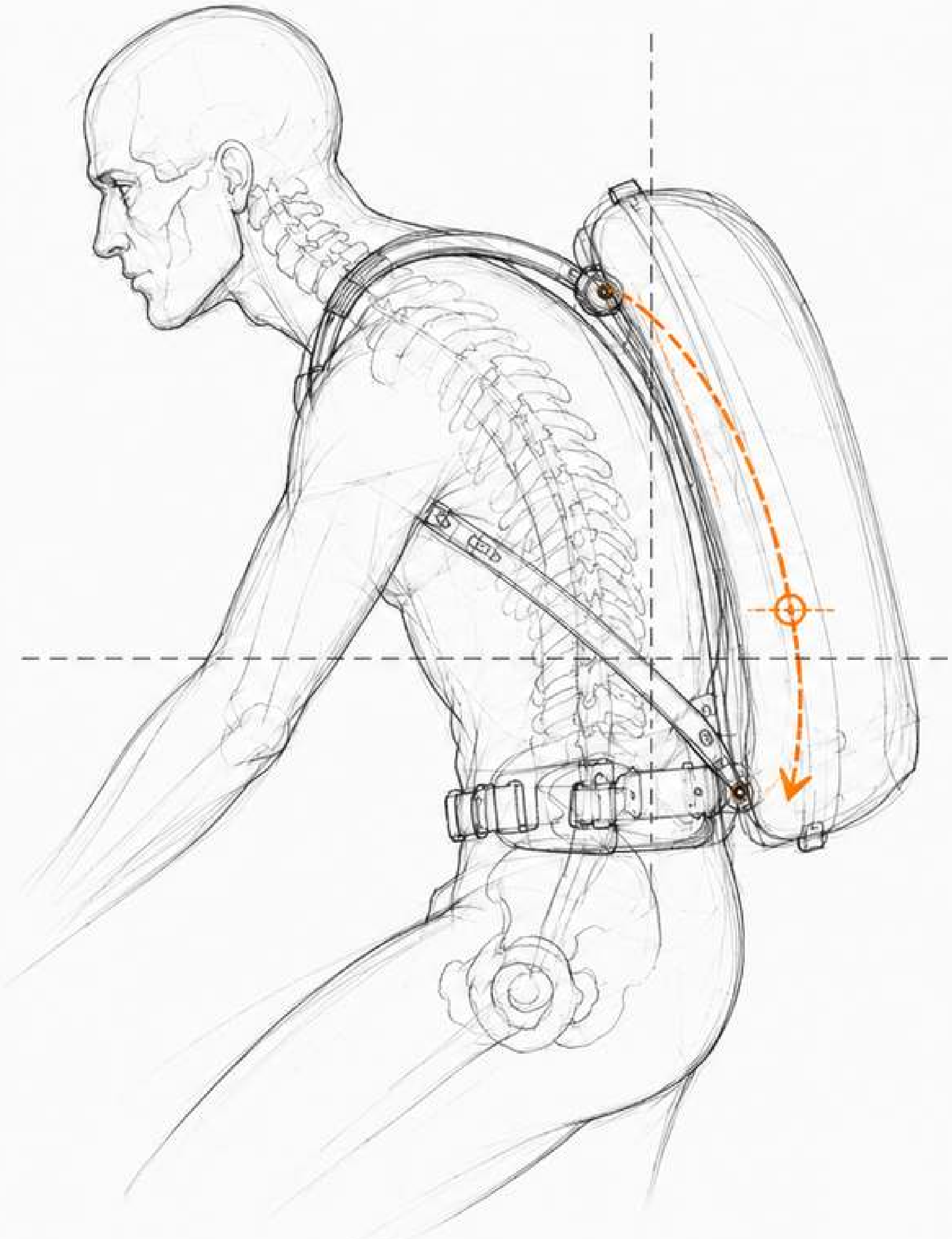
A wearable load-transfer system for urban e-bike commuters

01

UPRIGHT / WALKING

02

FORWARD LEAN / RIDING



COM

LOAD PATH

MOMENT ARM

01 KINEMATIC SECTION

LOAD BODY MOVEMENT COMPARISON

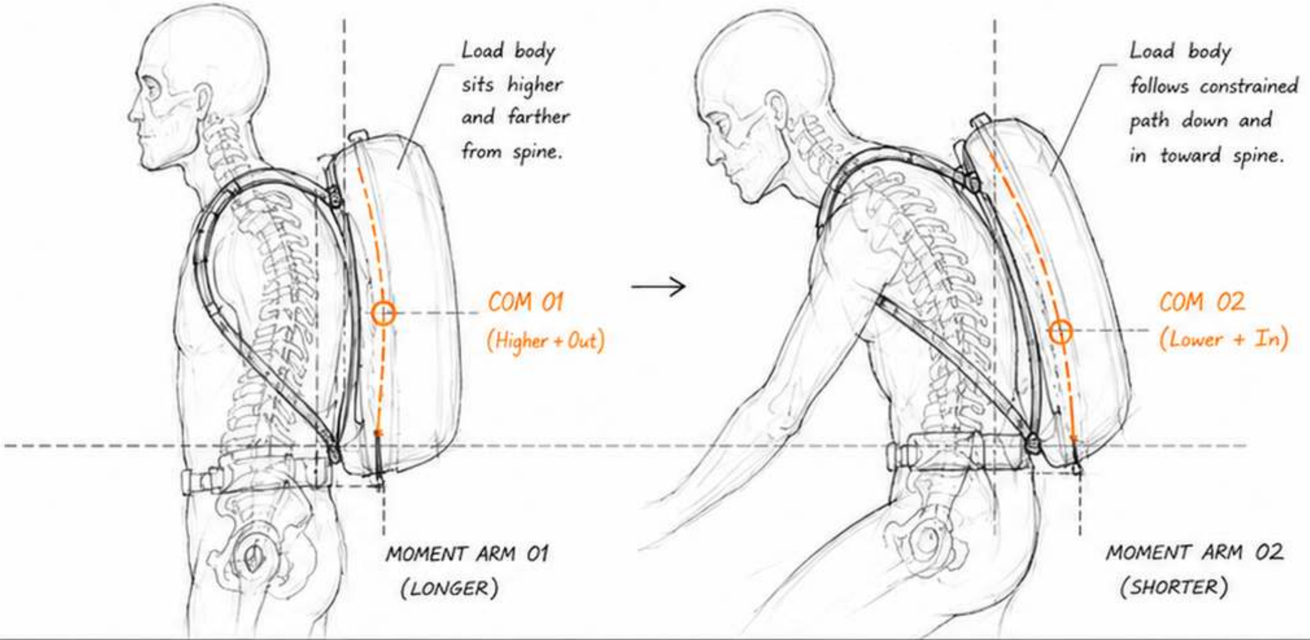
GOAL:

Reduce moment arm by moving load down and in during forward lean.

- ○ COM (LOAD)
- → LOAD PATH
- - - -> MOMENT ARM (HIP TO COM)
- ● FIXED BODY REFERENCE

STATE 01
UPRIGHT / WALKING

STATE 02
FORWARD LEAN / RIDING



MEASURED EFFECT (TARGET)

VERTICAL DROP (COM)
↓ ~100–150 mm

INWARD SHIFT (COM)
← ~60–100 mm

MOMENT ARM REDUCTION
↓ ~30–40%

PATH LENGTH (COM TRAVEL)
~200 mm

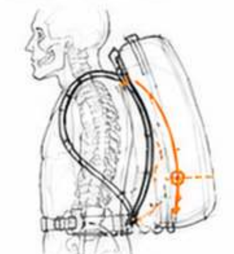
NOTES

- Values are conceptual targets for visualization.
- Actual results depend on mechanism + pack dimensions.
- Goal is to reduce moment arms and maintain load close to spine.

02 KINEMATIC PATH VARIANTS

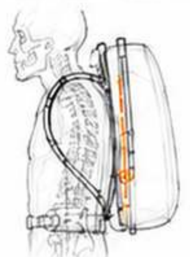
EXPLORATION OF CONSTRAINED MOTION LOGICS

01 CURVED DROP PATH



- Curved rail drives load down and in.
- Smooth continuous arc.
- Good for natural feel.

02 VERTICAL SLIDE PATH



- Linear track for direct vertical drop.
- Simple mechanism.
- Compact.

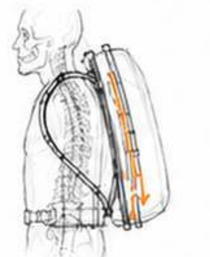
03 ROTATION + DROP

- Upper rotation reduces moment arm.
- Lower drop completes inward compression.

04 DUAL AXIS PATH

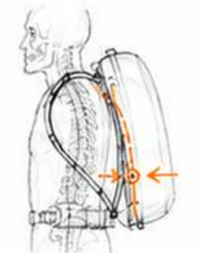
- Combination of inward translation + downward movement.
- Maintains close proximity through lean.

05 RAIL-GUIDED COMPRESSION



- Parallel rails guide downward + inward.
- Enables active compression at end of travel.

06 TENSION-SHORTENING



- Harness geometry shortens under lean.
- Load drawn in by tension differential.

ADDITIONAL EXPLORATIONS

PIVOT ABOUT SHOULDER (OVERHEAD INCREAEES MOMENT ARM) ✕

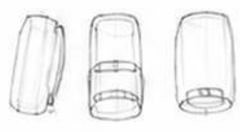
HIP-BASED PIVOT BETTER BUT LIMITED DROP ✕

CONSTRAINED PATH MOST EFFECTIVE ✓

03 KEY ANCHORS (REFERENCE ONLY)

- C7 (CERVICAL)
- T4 (UPPER THORACIC)
- T8 (MID THORACIC)
- L3 (LUMBAR)
- HIP JOINT (ROTATION CENTER)

04 DESIGN IMPLICATIONS



- Pack volume divided into upper (rotates) + lower (stabilizes)

- Mechanism lives in interface between load body and back panel.

- Path must clear shoulder blades and maintain comfort.

NEXT STEPS

- ☐ Pick 1–2 path concepts
- ☐ Build cardboard mockup
- ☐ Test with weight
- ☐ Measure COM travel
- ☐ Iterate

04 PHYSICAL PROTOTYPE (CARDBOARD MOCKUP)

RIDER REFERENCE: 170cm / 61kg / SM–M (36–38)

FRONT

LEFT SIDE (UPRIGHT)

LEFT SIDE (FORWARD LEAN)

BACK

LOW PIVOT DETAIL

TENSIONER ROUTE

HIP BELT DETAIL

UPPER HARNESS ANCHOR

Rotating axle on back panel rail allows upper strap to rotate.

TENSION STRAP (DIFFERENTIAL)

Differential strap runs over low pivot to create rotation and differential tension.

LOW PIVOT ASSEMBLY

Hip level pivot is the primary rotation point for the load body.

INWARD TETHER (SHORTENING)

Tether pulls the lower portion of the load body inward as the system shortens.

STABILIZING BELT (HIP BELT)

Hip belt stabilizes the system and resists lateral sway and uplift.

BACK PANEL / RAIL

Rigid rail constrains the path of the load body and maintains alignment.

03

MECHANISM

THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

02 MECHANISM DETAIL | 06 TENSION–SHORTENING PATH

A UPPER HARNESS ANCHOR (Shoulder)

B TENSION STRAP (Differential)

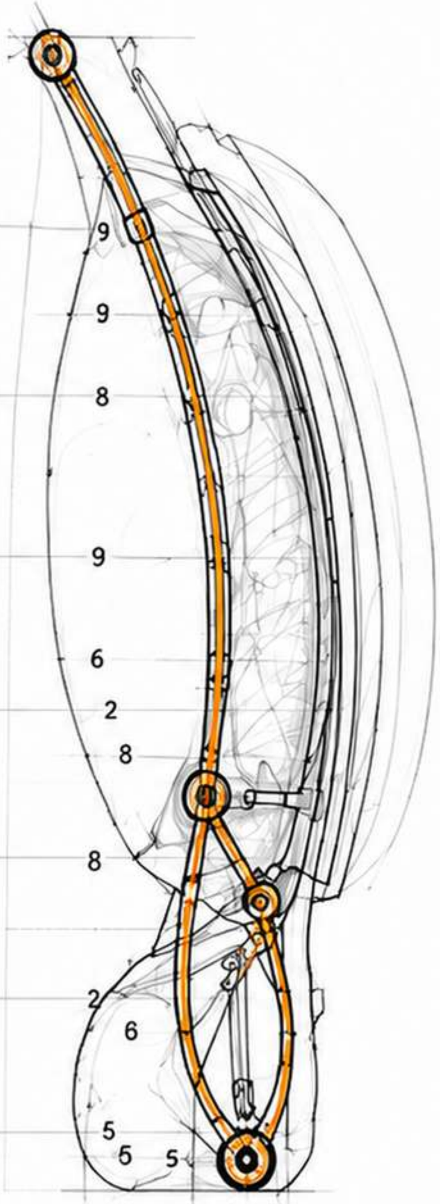
C LOAD BODY (Pack Volume)

D LOW PIVOT (Hip Level)

E INWARD TETHER (Shortening)

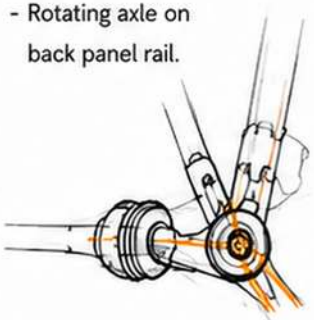
F BACK PANEL / RAIL

G STABILIZING BELT (Hip Belt)

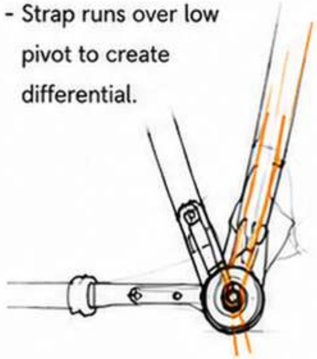


MECHANISM COMPONENTS

- **LOW PIVOT ASSEMBLY**
  - Rotating axle on back panel rail.



- **TENSIONER ROUTE**
  - Strap runs over low pivot to create differential.



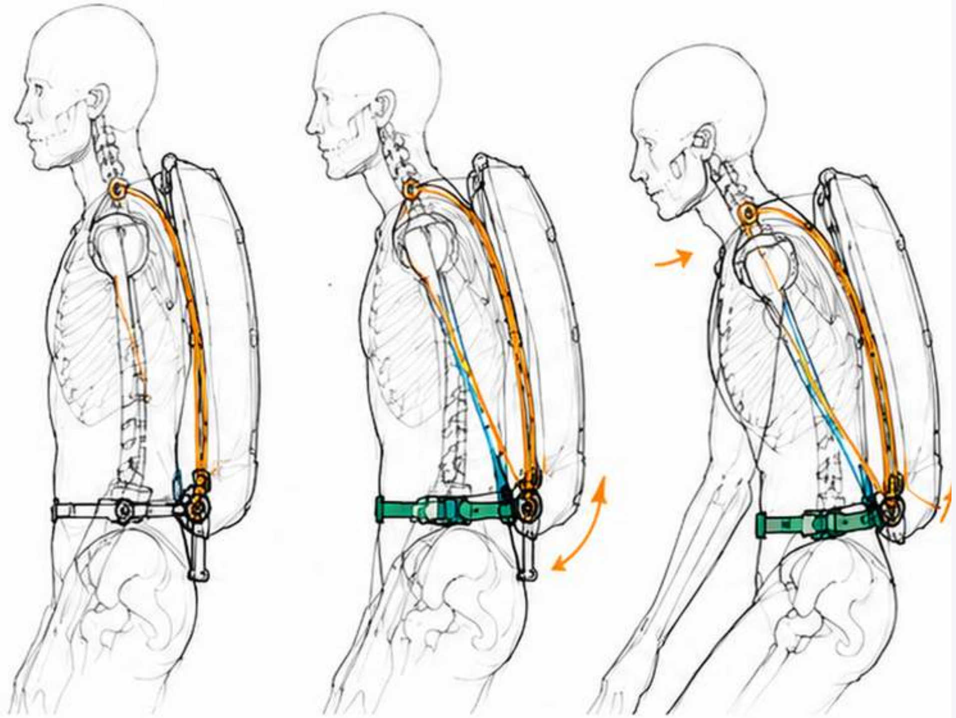
- **INWARD TETHER**
  - Pulls load body toward spine as system shortens.

KINEMATIC SEQUENCE (SIDE VIEW)

1 UPRIGHT

2 TRANSITION

3 FORWARD LEAN



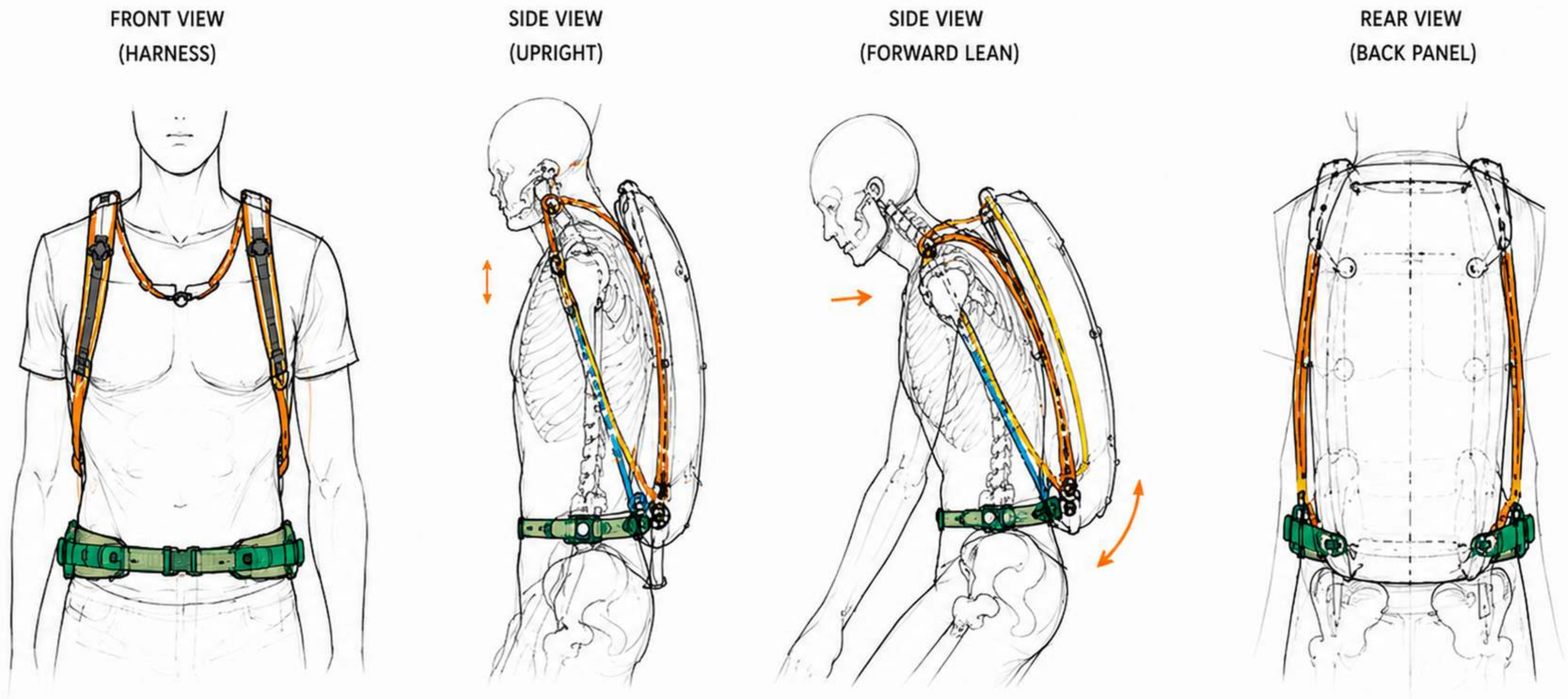
LOAD PATH (TENSION)

MOVEMENT OF LOAD BODY

SHORTENING / INWARD MOTION

COM MOVES DOWNWARD AND INWARD

03 STRAP ROUTING DIAGRAM



UPPER HARNESS STRAP (SHOULDER)

LOWER TENSION STRAP (DIFFERENTIAL)

INWARD TETHER (SHORTENING)

STABILIZING BELT (HIP)

○ PIVOT POINT

● FIXED ANCHOR

– – – RAIL / GUIDE PATH

⟷ ADJUSTMENT DIRECTION

RIDER-LEANING BIOMECHANICAL DIAGRAM

LOAD TRANSFER + COMPRESSION + STABILITY

UPRIGHT / WALKING

RELAXED POSTURE

Load sits closer to the back between the thoracic spine and lumbar region.

Center of Mass (COM) is higher and slightly further from the spine.

Longer moment arm (hip to COM) increases sway and fatigue.

CENTER OF MASS

Higher and slightly further from spine

MOMENT ARM

Longer

EFFECT

More sway potential and fatigue over time

FORWARD RIDING LEAN

RIDING POSTURE

Load body compresses and follows a guided path downward and inward.

COM moves lower and closer to the spine.

Shorter moment arm (hip to COM) reduces sway and improves stability and control.

CENTER OF MASS

Lower and closer to spine

MOMENT ARM

Shorter

EFFECT

Reduced sway, more control and less fatigue

FORCE & LOAD TRANSFER COMPARISON

UPRIGHT / WALKING

- GRAVITY LOAD
- CENTER OF MASS
- MOMENT ARM
- SWAY FORCE
- HIP SUPPORT

Greater sway force acts on the system. Load is higher and further from the body's centerline.

FORWARD RIDING LEAN

- GRAVITY LOAD
- CENTER OF MASS
- MOMENT ARM
- SWAY FORCE (REDUCED)
- HIP SUPPORT (INCREASED)

Sway force is reduced. Load is lower, closer, and aligned with the body's center for improved stability and efficiency.

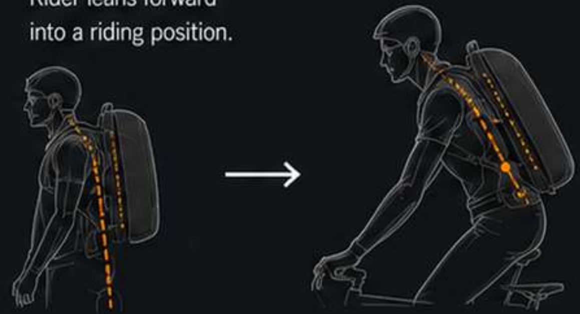
THE RESULT

LESS SWAY More stable movement	**LOWER MOMENT ARM** Reduced strain on back and hips	**BETTER BREATHING** Improved ventilation and comfort	**MORE CONTROL** Better balance and handling	**LOCKED & SECURE** Load stays in an optimal riding position

HOW IT WORKS

1 POSTURE CHANGE

Rider leans forward into a riding position.



2 GUIDED LOAD PATH

The load body follows an engineered path that moves downward and inward defined by the system.

3 COMPRESSION & LOCK

The harness and internal geometry pull the load inward and lock it in a stable riding position.

- COM (Center of Mass)
- Moment Arm (hip to COM)
- Load Path (Tension)
- Inward Compression (Tension)
- Hip Support (Compression)

KEY BENEFITS

- Reduces moment arm and sway
- Improves posture and control
- Decreases fatigue during dynamic riding
- Maintains ventilation and comfort
- Engineered movement adapts to the rider


Thoracic Pivot (T4-T6)
[Passive]
Laminated
Hypalon
Reinforcement
Weather-Resistant
Technical Textile
(Matte Charcoal)
Low-Profile
Ergo-Harness
Passive Angle
Transition
(Walking vs. Riding)
Detail 1
State A
(Upright Walking)
State B
(Forward Riding Lean)
Detail 2

04

COMPONENT DOCUMENTATION

THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

KEY / LEGEND

ECSS DESIGN DOCUMENTATION SYSTEM
SYMBOLS, MATERIALS, ABBREVIATIONS AND CONVENTIONS

THE ERGONOMIC CARRY SYSTEM
PROTOTYPE → PRODUCTION TRANSLATION
ECS–MT–01–R1

1. SYMBOL LEGEND

Ⓟ	**PIVOT POINT** Primary pivot for controlled movement.
Ⓡ	**ROLL / GUIDE INTERFACE** Component roller or translates along guide channel.
Ⓣ	**TENSION POINT** Applies or manages strap tension.
Ⓛ	**LOAD TRANSFER** Direction of load transfer through component.
Ⓘ	**INTEGRATION INTERFACE** Connection point between ECS components.
Ⓐ	**ANCHOR POINT** Structural attachment to harness frame.
------	**MOVEMENT PATH** Indicates component travel or articulation.
⟶	**LOAD PATH** Indicates direction of load transmission.
▨	**CONTACT SURFACE** Surface in contact with body or another component.
⬚	**ADJUSTMENT RANGE** Indicates adjustable travel or range.
🔒	**LOCKED / SECURED STATE** Component is locked or in secure position.
🔓	**UNLOCKED / RELEASED STATE** Component is released or free to move.

2. MATERIAL LEGEND


500D Nylon + PU (Shell)
High abrasion resistance, water resistant.


Closed-cell Foam
Cross-link foam for structure and comfort.


HDPE Sheet (Frame)
Semi-rigid structural support.


Nylon Webbing (Type 7)
High tenacity, low stretch webbing.


Bartack Thread (Bonded Nylon)
High strength, abrasion resistant.


POM / Nylon (Hardware)
Durable, low friction, dimensional stability.


3D Air Mesh
Breathable spacer mesh for comfort.

3. ABBREVIATIONS

A1	Upper Harness Anchor
A2	Rail / Guide Channel
A3	Load Body Assembly
A4	Low Pivot Assembly
A5	Inward Tether
A6	Tension Strap System
A7	Hip Belt Assembly
A8	Sternum Stabilizer
A9	Back Panel Comfort Pad
A10	Accessory / Attachment Interface
SR	Side Release (Buckle)
ITW	ITW Nexus (Hardware Brand)
HDPE	High Density Polyethylene
POM	Polyoxymethylene (Acetal)
PU	Polyurethane
ECS	Ergonomic Carry System

4. HARDWARE LEGEND


SR BUCKLE (LOW PROFILE)
Low-profile side release buckle for one-handed opening and adjustment.


LADDER LOCK
Webbing length adjustment.


SIDE RELEASE BUCKLE
Low-profile side release buckle for detachable connections.


D-RING
Attachment point for accessories or tethering.


RIVET / FASTENER
Structural fastening or pivot retention.


CORD PULL
Ergonomic pull for adjustment or release.

LINE WEIGHT CONVENTIONS

———	Visible Edge (Object)	0.70 mm
·–·–·–	Hidden Edge	0.35 mm
–·–·–	Centerline / Axis	0.25 mm
———	Movement Path	0.50 mm
------	Load Path	0.70 mm

All dimensions in millimeters unless otherwise noted.

5. TOLERANCE LEGEND

GENERAL TOLERANCE (UNLESS OTHERWISE NOTED)	± 0.5 mm
MOLDED PARTS	± 0.2 mm
MACHINED PARTS	± 0.1 mm
WEBBING LENGTH	± 1 mm
STITCHING LOCATION	± 1 mm
PIVOT / HOLE POSITION	± 0.5 mm
ROLL / CHANNEL POSITION	± 0.5 mm
ASSEMBLY FIT	Functional fit
ANGULAR TOLERANCE	± 1.0°

6. DOCUMENTATION CONVENTIONS

- All views are shown in the primary functional orientation unless otherwise noted.
- Left / Right are referenced as if worn by the user.
- Front / Back references are user-facing.
- Dimensions are in millimeters.
- Exploded views show assembly order with numeric callouts.
- All components are designed for disassembly and service.
- Materials and hardware are specified for production intent, not brand lock-in.

7. DOCUMENT INDEX (COMPONENT SHEETS)

DATE: 25–05–18 USE THIS LEGEND ACROSS ALL DOCUMENTATION PAGES FOR CONSISTENCY AND CLARITY. SCALE: NTS

ECS-MT-02-R1 | PROTOTYPE → PRODUCTION TRANSLATION MATRIX

COMPONENTS A1–A5

GOAL: Map the cardboard prototype (test object) to the designed production version (manufacturing intent).

COMPONENT	PROTOTYPE (TEST OBJECT) Materials & Construction		KEY	PRODUCTION (DESIGNED OBJECT) Materials & Construction		KEY
A1 Upper Harness Anchor		• Material: Corrugated cardboard (3–5 mm) • Reinforcement: Layered cardboard • Attachment: Tape / Hot glue • Function: Test anchor location and load direction	PC-1		• Material: 500D Nylon + PU (M1) • Reinforcement: Bartack stitching • Hardware: ITW Nexus Ladder Lock 25mm (M8) • Function: Primary load transfer to harness frame via pivot system	M1 M8
A2 Rail / Guide Channel		• Material: Corrugated cardboard • Construction: Slot cut and folded • Attachment: Tape / Hot glue • Function: Guide strap movement during prototype evaluation	PC-1		• Material: 6061-T6 Aluminum Rail (M7) • Finish: Anodized black • Attachment: Riveted / Screw fixed • Function: Precisely guides strap for controlled movement	M7 M10
A3 Load Body Assembly		• Material: Corrugated cardboard • Padding: Foam sheet (EVA) • Attachment: Tape / Zip ties • Function: Test load close to back and overall geometry	PF-1		• Material (Shell): 500D Nylon + PU (M1) • Panel: HDPE Structural Sheet (M4) • Padding: Closed-Cell Foam (M2) + 3D Spacer Mesh (M3) • Attachment: Bartack stitching + Rivets • Function: Distribute load body that carries and protects the load	M1 M4 M2 M3
A4 Low Pivot Assembly		• Material: Corrugated cardboard • Pivot: Split pin (paper fastener) • Washers: Cardboard discs • Function: Test pivot location and rotation	PH-1		• Material (Bracket): GF Nylon (M9) • Pivot Pin: Stainless steel (M13) • Bearings / Washers: Acetal (M10) • Attachment: Riveted / Screw fixed (M14) • Function: Low pivot for load path rotation and comfort	M9 M10
A5 Inward Tether		• Material: Cardboard strip • Attachment: Tape / Glue • Adjuster: Cardboard slot • Function: Test inward pull and positioning	PC-1		• Material: 25 mm Nylon Webbing (M6) • Adjuster: ITW Nexus Ladder Lock 25mm (M8) • Attachment: Bartack stitching • Function: Pulls load inward to minimize leverage	M6 M8

MATERIAL KEY (M)

M1	M2	M3	M4	M6	M7
500D Nylon + PU	Closed-Cell Foam	3D Spacer Mesh	HDPE Sheet	25mm Nylon Webbing	Aluminum Rail

HARDWARE KEY (H)

M8	M9	M10	M13	M14
ITW Nexus Hardware	GF Nylon Hardware	Acetal / POM Components	Stainless Steel Pivot Pin Silver	STAINLESS STEEL BUTTON HEAD RIVET BLACK OXIDE

PROTOTYPE KEY (P)

PC-1	PF-1	PH-1
Corrugated Cardboard (3–5 mm)	Foam Sheet (EVA)	Paper Fastener (Prototype Hardware)

NOTES:

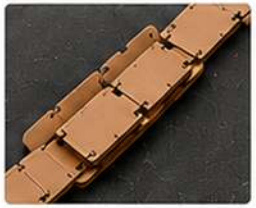
- Prototype materials are for fit, form and function testing only. Production materials are selected for durability, performance and manufacturability.
- All dimensions in millimeters unless otherwise noted.
- See individual component sheets (A1–A5) for detailed specifications and tolerances.

DATE: 25–05–18 USE THIS LEGEND ACROSS ALL DOCUMENTATION PAGES FOR CONSISTENCY AND CLARITY. SCALE: NTS

ECS-MT-02-R1 | PROTOTYPE → PRODUCTION TRANSLATION MATRIX

COMPONENTS A6–A10

GOAL: Map the cardboard prototype (test object) to the designed production version (manufacturing intent).

COMPONENT	PROTOTYPE (TEST OBJECT) Materials & Construction		KEY		PRODUCTION (DESIGNED OBJECT) Materials & Construction		KEY
A6 Tension Strap System		• Material: Cardboard strip • Adjuster: Cardboard slot • Attachment: Tape • Function: Test tensioning and range of adjustment	PC-1	→		• Material: 25 mm Nylon Webbing (M6) • Adjuster: ITW Nexus Ladder Lock 25mm (M8) • Attachment: Bartack stitching • Function: Apply and manage tension to stabilize load	M6 M8
A7 Hip Belt Assembly		• Material: Corrugated cardboard • Padding: Foam sheet (EVA) • Buckle: Plastic side release (taped in place) • Function: Test hip belt position and support	PF-1	→		• Material (Belt): 500D Nylon + PU (M1) • Padding: Closed-Cell Foam (M2) + 3D Spacer Mesh (M3) • Buckle: Side Release Low Profile (M8) • Attachment: Bartack stitching • Function: Test support load on hips and improve comfort	M1 M2 M3 M8
A8 Sternum Stabilizer		• Material: Cardboard strip • Buckle: Plastic side release (taped in place) • Adjuster: Cardboard slot • Function: Test shoulder strap spread and positioning	PC-1	→		• Material: 25 mm Nylon Webbing (M6) • Buckle: Low-Profile Side Release (M8) • Adjuster: ITW Nexus Ladder Lock 25mm (M8) • Attachment: Bartack stitching • Function: Test/limit shoulder strap spread for system stability under load	M6 M8 M8
A9 Back Panel Comfort Pad		• Material: Foam sheet (EVA) • Attachment: Tape • Function: Test back comfort and ventilation zones	PF-1	→		• Material: 3D Spacer Mesh (M3) • Padding: Closed-Cell Foam (M2) • Backing: 500D Nylon + PU (M1) • Attachment: Bartack stitching • Function: Comfort, ventilation, and pressure distribution	M3 M2 M1
A10 Accessory / Attachment Interface		• Material: Cardboard tab • Attachment: Tape • Function: Test accessory attachment location	PC-1	→		• Material: 25 mm Nylon Webbing (M6) • Hardware: D-Ring / Cord Pull / Rivet (M8, M10) • Attachment: Bartack + Rivet • Function: Accessory attachment or tethering point	M6 M8 M10

MATERIAL KEY (M)

- **M1** 500D Nylon + PU
- **M2** Closed-Cell Foam
- **M3** 3D Spacer Mesh
- **M4** HDPE Sheet
- **M6** 25mm Nylon Webbing
- **M7** Aluminum Rail

HARDWARE KEY (H)

- **M8** ITW Nexus Hardware
- **M9** GF Nylon Hardware
- **M10** Acetal / POM Components
- **M13** Stainless Steel Pivot Pin Silver
- **M14** STAINLESS STEEL BUTTON HEAD RIVET BLACK OXIDE

PROTOTYPE KEY (P)

- **PC-1** Corrugated Cardboard (3–5 mm)
- **PF-1** Foam Sheet (EVA)
- **PH-1** Paper Fastener (Prototype Hardware)

NOTES:

- Prototype materials are for fit, form and function testing only. Production materials are selected for durability, performance and manufacturability.
- All dimensions in millimeters unless otherwise noted.
- See individual component sheets (A6–A10) for detailed specifications and tolerances.

A1 UPPER HARNESS ANCHOR

SHOULDER HARNESS TOP ANCHOR + LOAD TRANSFER

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25-05-18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)

MATERIAL

- Corrugated cardboard (3–5 mm)
- Reinforcement: Layered cardboard
- Attachment: Tape / Hot glue

FUNCTION

- Test anchor location and load direction
- Simulate strap angle and pull
- Evaluate comfort and stability

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 500D Nylon + PU (M1)
- Reinforcement: Bartack stitching
- Hardware: ITW Nexus Ladder Lock 25mm (M8)

FUNCTION

- Primary load transfer to harness frame
- Stabilizes shoulder straps
- Distributes load evenly across upper back

NOTES

- Load-rated component
- Impact resistant
- Designed for dynamic use

MATERIAL KEY (M)

M1 500D Nylon + PU Black

M8 ITW NEXUS LADDER LOCK 25mm Black

HARDWARE KEY (H)

M8 ITW NEXUS LADDER LOCK 25mm Black

KEY SPECIFICATIONS

Overall Width (W)	142 mm
Overall Height (H)	142 mm
Overall Thickness (T)	13 mm
Strap Width	25 mm
Ladder Lock Width	25 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	32 g
Operating Temp.	−20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)

1. Top wings create shoulder strap angle.
2. Central slot aligns harness top.
3. Layered cardboard adds strength.

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW

MOUNTED VIEW

TOLERANCES

Overall Width (W)	± 1.0 mm
Overall Height (H)	± 1.0 mm
Overall Thickness (T)	±0.3 mm
Strap Width	±0.5 mm
Ladder Lock Width	±0.5 mm
Stitching Position	± 1.0 mm

HARDWARE REFERENCE

M8 ITW NEXUS LADDER LOCK 25mm BLACK

M10 GF NYLON HARDWARE BLACK

COMPATIBILITY

- Interfaces with A2 (Rail / Guide Channel) via webbing
- Works with A3 (Load Body Assembly) connection
- Supports A4 (Low Pivot Assembly) strap routing
- Compatible with harness systems using 25 mm webbing

MOVEMENT / FUNCTION SEQUENCE

1. **NEUTRAL** Anchor holds shoulder straps in natural position.
2. **LOAD APPLIED** Load pull through straps into anchor.
3. **STABILIZATION** Anchor stabilizes pull prevents strap splay.
4. **LOAD TRANSFER** Load is transferred into harness frame and body.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

A2 RAIL / GUIDE CHANNEL

A4 LOW PIVOT ASSEEBLY

A3 LOAD BODY ASSEMBLY

A5 INWARD TETHER

ENGINEERING NOTES

- Engineered for primary load transfer from shoulder straps.
- Bartack stitching in critical load areas for durability.
- Reinforced layers prevent deformation under dynamic load.
- Hardware selected for strength, UV and corrosion resistance.
- Symmetrical design ensures even load distribution.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

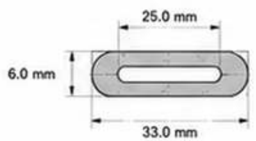
- Optimize angle to maintain ergonomic strap alignment.
- Minimize bulk while maintaining strength and comfort.
- Ensure smooth transitions to prevent wear on straps.
- Distribute load evenly to reduce pressure points.
- Maintain compatibility with standard strap widths.

NOTES (ABOUT THIS COMPONENT)

The upper harness anchor is the top connection point of the shoulder straps. It plays a critical role in stabilizing the harness and transferring load into the harness frame, improving comfort and control during dynamic activities. Designed for durability, strength, and field serviceability.

DIMENSIONS (PRODUCTION OBJECT)

SLOT DETAIL (LADDER LOCK)



DOCUMENT INFO

Component ID	A1		
Document ID	ECS-A1-ISO-01-R1		
Revision	R1	Scale	NTS (mm)
Date	25-05-18	Prepared By	ECS Design Team

A2 RAIL / GUIDE CHANNEL

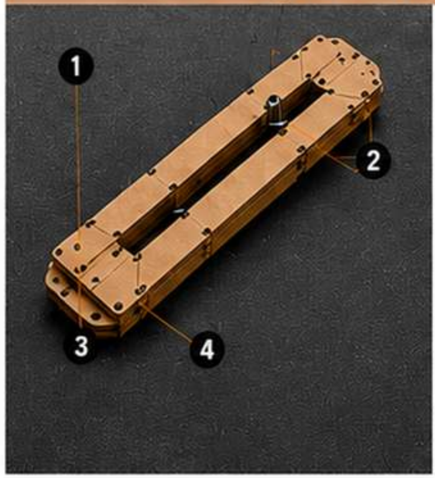
GUIDED STRAP PATH CONTROL + LATERAL STABILIZATION

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard (3–5 mm)
- Tape reinforcement
- Hot glue joints

FUNCTION

- Guides strap movement
- Maintains strap alignment
- Reduces lateral strap drift
- Simulates controlled migration

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 6061–T6 Aluminum (M7)
- Low-profile rail geometry
- Recessed guide channel
- Rounded, low friction edges
- Anodized, wear resistant

FUNCTION

- Controls guided strap migration
- Maintains lateral load path
- Reduces lateral sway
- Constrains strap under load
- Provides smooth transitions during posture changes

NOTES

- Load-rated component
- Impact resistant
- Corrosion & UV resistant

MATERIAL KEY (M)

M7 6061–T6 Aluminum Rail Anodized Black

HARDWARE KEY (H)

M10 GF Nylon End Cap / Stop Black

KEY SPECIFICATIONS

Overall Length (L)	142 mm
Overall Width (W)	25 mm
Overall Height (H)	8.0 mm
Rail Channel Width (RCW)	6.0 mm
Rail Channel Depth (RCD)	4.0 mm
Mounting Hole Ø (MH)	4.5 mm
Mounting Hole Spacing (S)	126 mm
Load Rating (per rail)	> 1.5 kN
Weight (approx.)	28 g
Operating Temp.	-20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)

1. Slot channel guides strap movement.

2. Layered cardboard build creates channel walls.

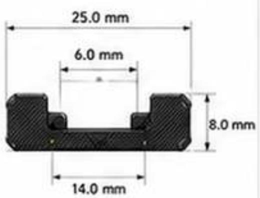
3. Tape reinforcement reduces deformation during testing.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW



MOUNTED VIEW

TOLERANCES

Overall Length (L)	±1.0 mm
Overall Width (W)	±0.3 mm
Overall Height (H)	±0.3 mm
Rail Channel Width (RCW)	±0.2 mm
Rail Channel Depth (RCD)	±0.2 mm
Mounting Hole Ø (MH)	±0.1 mm
Mounting Hole Spacing (S)	±0.5 mm

HARDWARE REFERENCE

M10
GF NYLON
END CAP / STOP
BLACK

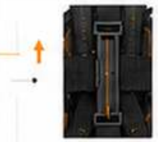
M8
BUTTON HEAD SCREW
STAINLESS STEEL
BLACK OXIDE

COMPATIBILITY

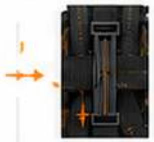
- Interfaces with A1 (Upper Harness Anchor) via webbing path
- Works with A3 (Load Body Assembly) connection
- Supports A4 (Low Pivot Assembly) strap routing
- Compatible with systems using 25 mm webbing

MOVEMENT / FUNCTION SEQUENCE

1. NEUTRAL Strap centered in rail channel.



2. LOADED Strap pulled inward. Rail guides path and limits lateral migration.



3. TRANSITION During posture change, rail maintains alignment and prevents sway.

4. DYNAMIC MOTION Rail constrains strap geometry under dynamic load.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

A1 UPPER HARNESS ANCHOR

A3 LOAD BODY ASSEMBLY

A5 INWARD TETHER

A8 STERNUM STABILIZER (INFLUENCE PATH)

ENGINEERING NOTES

- Recessed channel geometry ensures smooth, controlled strap movement.
- Low-friction surfaces reduce wear on webbing.
- Rounded edges prevent strap edge wear and webbing abrasion.
- Rail maintains strap plane to reduce lateral load migration.
- Material selected for strength, corrosion resistance, and low weight.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

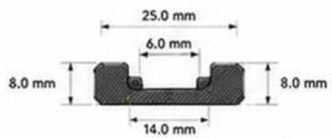
- Maintain low profile to avoid interference with rider's body and gear.
- Ensure consistent rail alignment with shoulder strap path.
- Prevent binding while maintaining tight strap guidance.
- Accommodate strap thickness variations.
- Minimize weight while maintaining structural integrity.

NOTES (ABOUT THIS COMPONENT)

The rail / guide channel is a critical component that controls the movement of the shoulder strap along a guided path. It maintains strap alignment, reduces lateral sway, and ensures the load is transferred efficiently to the harness frame. Designed for durability, smooth operation, and long-term field reliability.

DIMENSIONS (PRODUCTION OBJECT)

SECTION A–A (TYPICAL)



DOCUMENT INFO

Component ID	A2		
Document ID	ECS–A2–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A3 LOAD BODY ASSEMBLY

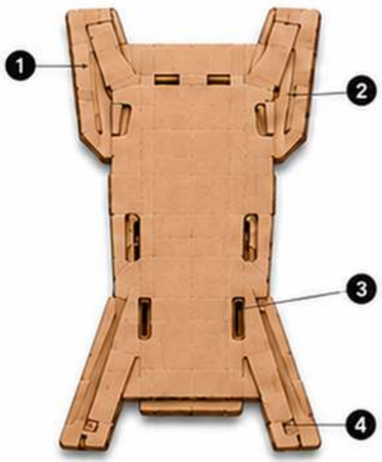
RIGID STRUCTURE FOR LOAD TRANSFER + SYSTEM INTEGRATION

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25-05-18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard (3–5 mm)
- Tape reinforcement
- Hot glue

FUNCTION

- Provides structural platform for load distribution
- Transfers load to anchor points
- Maintains system geometry

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- 2.0 mm HDPE structural panel
- Laser-cut slots for modularity
- 25 mm nylon webbing (M6)
- Bartack reinforcement
- Rounded low-profile edges

FUNCTION

- Rigid platform for load transfer and system integration
- Distributes load across anchors and body
- Maintains geometry under dynamic load

NOTES

- Load-rated structure
- Impact resistant
- Corrosion & UV resistant

MATERIAL KEY (M)

M4	HDPE STRUCTURAL PANEL 2.0 mm High Density Polyethylene
M6	25 mm HIGH-TENACITY NYLON WEBBING Type 7, Bartacked
M5	NYLON REINFORCEMENT LAYER (OPTIONAL) Type 6, Heat Set

HARDWARE KEY (H)

M8	ITW NEXUS SIDE RELEASE BUCKLE 25mm
M8	ITW NEXUS TRI-GLIDE ADJUSTER 25mm

KEY SPECIFICATIONS

Overall Height (H)	240 mm
Overall Width (W)	170 mm
Panel Thickness (T)	2.0 mm
Webbing Width	25 mm
Slot Width (S)	25 mm
Slot Length (L)	38 mm
Panel Weight (approx.)	110 g
Load Rating (per assembly)	> 2.5 kN
Operating Temp.	−20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)

1. Slot layout defines strap paths.

2. Tape joins hold structure during testing.

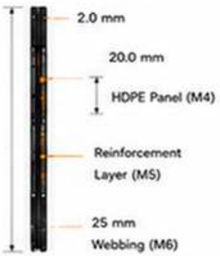
3. Layered cardboard adds basic rigidity.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW



MOUNTED VIEW

TOLERANCES

Overall Height (H)	±1.0 mm
Overall Width (W)	±1.0 mm
Panel Thickness (T)	±0.2 mm
Slot Width (S)	±0.5 mm
Slot Location	±1.0 mm

HARDWARE REFERENCE

M8 ITW NEXUS SIDE RELEASE BUCKLE 25mm

M8 ITW NEXUS TRI-GLIDE ADJUSTER 25mm

COMPATIBILITY

- Interfaces with A1 (Upper Anchor) via webbing
- Works with A5 (Inward Tether) for load path control
- Fastened to A2 (Guide Channel) for support
- Supports A8 (Sternum Stabilizer) via geometry

MOVEMENT / FUNCTION SEQUENCE

1. **NEUTRAL** Load body in resting position.
2. **LOAD APPLIED** Load transfers evenly through structure.
3. **DYNAMIC MOVEMENT** Structure maintains shape during rider lean.
4. **RECOVERY** Returns to neutral without deformation.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- HDPE panel provides rigid load transfer with minimal weight.
- Slot architecture allows modular strap routing and adjustment.
- Rounded edges prevent wear on straps and improve comfort.
- Reinforced layers at problem zones contribute to added stiffness.
- Material selected for durability, UV resistance, wear resistance, and impact performance.
- Assembly is serviceable and replaceable in the field if required.

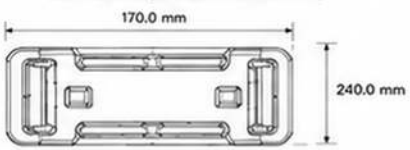
DESIGN CONSIDERATIONS

- Maintain low profile to reduce bulk under gear or clothing.
- Distribute load evenly to avoid pressure points.
- Slot positions optimized for typical rider posture range.
- Prevent strap binding while maintaining slot geometry.
- Ensure compatibility with existing anchor and tether layout.
- Minimize weight while maintaining structural performance.

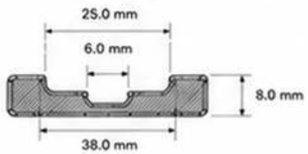
NOTES (ABOUT THIS COMPONENT)

The load body assembly is the central structural platform of the carry system. It is designed to transfer and distribute load from the carriage to the wearer through multiple anchor points while maintaining alignment and comfort during dynamic riding conditions.

DIMENSIONS (PRODUCTION OBJECT)



SLOT DETAIL



DOCUMENT INFO

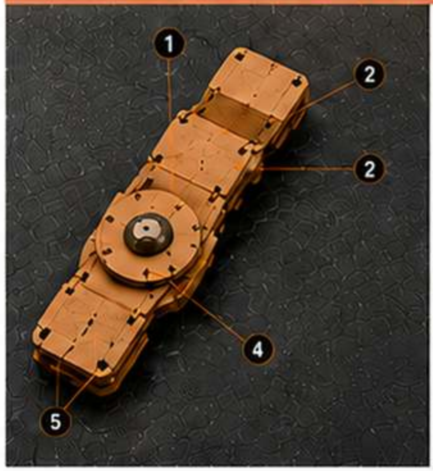
Component ID	A3		
Document ID	ECS-A3-ISO-01-R2		
Revision	R2	Scale	NTS (mm)
Date	R1 25-05-18	Prepared By	ECS Design Team

A4 LOW PIVOT ASSEMBLY

PIVOT CONNECTION + LOAD TRANSFER OPTIMIZATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard
- Cardboard washer discs
- Tape reinforcement
- Hot glue joints

FUNCTION

- Enables pivot rotation
- Transfers load to strap system
- Allows harness articulation
- Maintains alignment under load

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material (Bracket): GF Nylon (M9)
- Pivot Pin: Stainless steel (M13)
- Bearings / Washers: Acetal (M10)
- Attachment: Riveted / Screw fixed

FUNCTION

- Provides smooth pivot rotation
- Transfers load from harness to frame
- Allows natural body articulation
- Maintains alignment and comfort
- Low profile for reduced bulk

NOTES

- Load-rated component
- Impact resistant
- Corrosion & UV resistant
- Serviceable and replaceable

MATERIAL KEY (M)

M9	GF Nylon Bracket	
M10	Acetal / POM Washer / Bearing Black	
M13	Stainless Steel Pivot Pin Silver	

HARDWARE KEY (H)

M14 STAINLESS STEEL BUTTON HEAD RIVET BLACK OXIDE

KEY SPECIFICATIONS

Pivot Pin Diameter (ØD)	6.0 mm
Bracket Thickness (BT)	8.0 mm
Washer Thickness (WT)	2.0 mm
Assembly Width (AW)	25.0 mm
Assembly Height (AH)	25.0 mm
Rotation Range	±30°
Mounting Hole Ø (MH)	6.5 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	22 g
Operating Temp.	–20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)

1. Split pivot allows rotation.
2. Cardboard washer simulates bearing.
3. Tape reinforcement reduces wear and improves durability.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW

MOUNTED VIEW

TOLERANCES

Pivot Pin Diameter (ØD)	±0.1 mm
Bracket Thickness (BT)	±0.3 mm
Washer Thickness (WT)	±0.2 mm
Assembly Width (AW)	±0.3 mm
Assembly Height (AH)	±0.3 mm
Mounting Hole Ø (MH)	±0.2 mm

HARDWARE REFERENCE

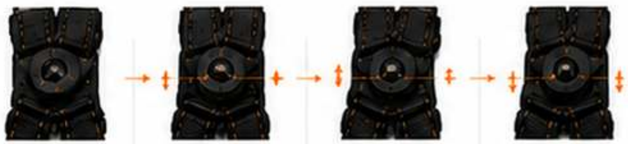
M9
STAINLESS STEEL BUTTON HEAD RIVET BLACK OXIDE

M10
ACETAL / POM WASHER / BEARING BLACK

COMPATIBILITY

- Interfaces with A1 (Upper Anchor) Ambing)
- Interfaces with A3 (Load Body Assembly)
- Works with AS (Inward Tether) for load path control
- Supports dynamic rotation ± 30°

MOVEMENT / FUNCTION SEQUENCE



1. NEUTRAL
Pivot in neutral aligned position.

2. ROTATION START
Pivot begins rotation to allow articulation.

3. ARTICULATION
Allows natural body movement and flex.

4. LOAD TRANSFER
Load remains centered, transferred efficiently.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Low pivot location improves biomechanics.
- Acetal washers reduce friction and wear.
- Stainless steel pin ensures high strength and durability.
- Riveted construction prevents loosening.
- Bracket geometry distributes load evenly.
- Designed for high cycle articulation.
- Materials selected for strength, low weight, and corrosion resistance.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

- Maintain low profile to avoid interference with body.
- Ensure smooth pivot for unrestricted movement.
- Maintain alignment to prevent strap twist.
- Protect pivot area from dirt and debris.
- Balance strength, weight, and comfort.
- Accommodate strap thickness variations.
- Minimize play while allowing smooth rotation.

NOTES (ABOUT THIS COMPONENT)

The low pivot assembly is the articulation point between the harness and load body system. It enables natural body movement while maintaining efficient load transfer and alignment. Designed for durability, smooth operation, and long-term field reliability.

DIMENSIONS (PRODUCTION OBJECT)

ROTATION RANGE (TYPICAL)

DOCUMENT INFO

Component ID	A4		
Document ID	ECS–A4–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A5 INWARD TETHER

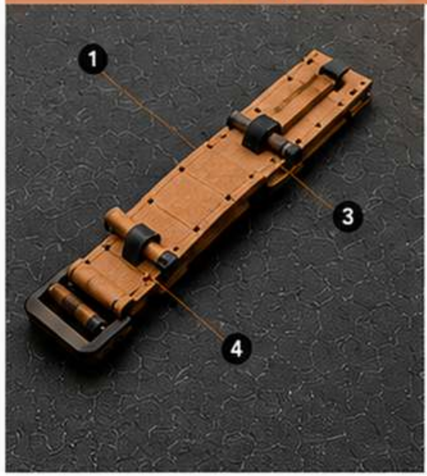
INWARD PULL TRANSFER + LOAD PATH CONTROL

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard (3–5 mm)
- Tape reinforcement
- Hot glue joints

FUNCTION

- Tests inward pull and positioning
- Simulates strap load adjustment
- Validates load path to harness

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 25 mm Nylon Webbing (M6)
- Adjuster: ITW Nexus Ladder Lock 25mm (M8)
- Attachment: Bartack stitching
- Function: Transfers inward load to harness via guided path

FUNCTION

- Pulls load inward to minimize leverage
- Works with guided rail for alignment
- Maintains load path under tension
- Reduces strap drift and sway

NOTES

- Load-rated component
- Impact resistant
- Designed for dynamic use

MATERIAL KEY (M)

M6 25 mm Nylon Webbing Black

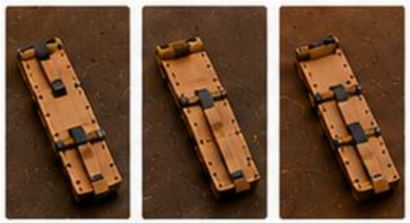
HARDWARE KEY (H)

M8 ITW NEXUS LADDER LOCK 25mm Black

KEY SPECIFICATIONS

Webbing Width (WW)	25 mm
Webbing Thickness (WT)	2.0 mm
Adjuster Type	ITW Nexus Ladder Lock 25mm
Adjuster Width (AW)	25 mm
Adjuster Height (AH)	20 mm
Slot Width (SW)	25 mm
Slot Height (SH)	4.5 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	18 g
Operating Temp.	–20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)



1. Slot simulates adjustment path.
2. Tape reinforcement simulates stitching.
3. End tabs simulate load transfer points.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW

MOUNTED VIEW

TOLERANCES

Webbing Width (WW)	±0.3 mm
Webbing Thickness (WT)	±0.2 mm
Adjuster Width (AW)	±0.3 mm
Adjuster Height (AH)	±0.3 mm
Slot Width (SW)	±0.2 mm
Slot Height (SH)	±0.2 mm
Stitching Position	±1.0 mm

HARDWARE REFERENCE

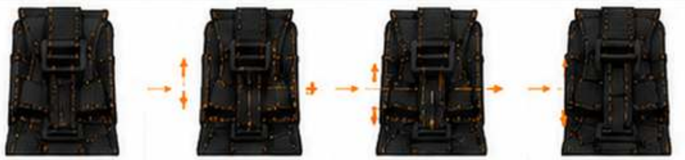
M8 ITW NEXUS LADDER LOCK 25mm BLACK

M9 BUTTON HEAD SCREW STAINLESS STEEL BLACK OXIDE

COMPATIBILITY

- Interfaces with A1 (Upper Harness Anchor)
- Interfaces with A2 (Rail / Guide Channel)
- Works with A4 (Low Pivot Assembly)
- Supports inward load transfer to harness

MOVEMENT / FUNCTION SEQUENCE



1. **NEUTRAL** Tether at rest, no tension.
2. **PULL APPLIED** User or system pulls tether inward.
3. **LOAD TRANSFER** Load moves inward, reducing leverage.
4. **STABILIZED** Load path aligned, sway minimized.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Inward pull reduces moment arm and improves load control.
- Ladder Lock provides secure, low-profile adjustment.
- Webbing selected for strength, low stretch, and abrasion resistance.
- Bartack stitching prevents slippage and failure at load points.
- Designed for durability, field reliability, and serviceability.

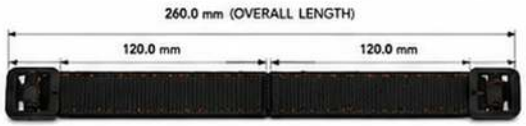
DESIGN CONSIDERATIONS

- Maintain consistent strap alignment with guide rail.
- Minimize bulk while ensuring load transfer performance.
- Prevent twisting during tensioning.
- Keep adjustment accessible yet secure.
- Optimize stitching pattern for strength and low profile.
- Minimize weight while maintaining durability.

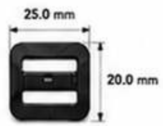
NOTES (ABOUT THIS COMPONENT)

The inward tether is a critical load transfer component that pulls the load toward the user's center of mass. It works with the guided rail and tension system to reduce sway, minimize leverage, and maintain control. Designed for strength, low profile, and long-term field reliability.

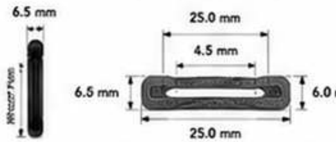
DIMENSIONS (PRODUCTION OBJECT)



LADDER LOCK (M8)



SLOT DETAIL (TYPICAL)



DOCUMENT INFO

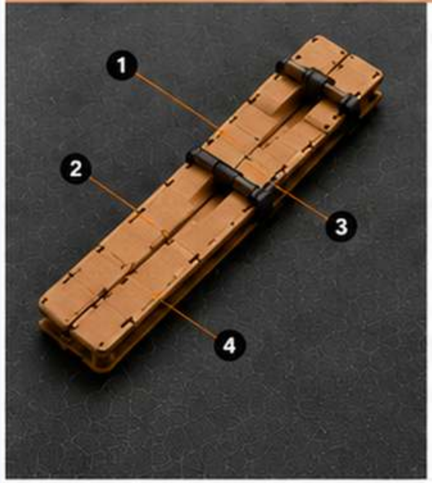
Component ID	A5		
Document ID	ECS–A5–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A6 TENSION STRAP SYSTEM

ADJUSTABLE TENSIONING + LOAD STABILIZATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard (3–5 mm)
- Cardboard slot adjuster
- Tape reinforcement
- Hot glue joints

FUNCTION

- Tests tensioning and range
- Simulates strap load adjustment
- Validates strap alignment
- Evaluates load stabilization

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

1. Material: 25 mm Nylon Webbing (M6)
2. Adjuster: ITW Nexus Ladder Lock 25mm (M8)
3. Attachment: Bartack stitching
4. Function: Apply and manage tension
   Works with guided rail system

FUNCTION

- Applies tension to stabilize load
- Reduces movement and sway
- Maintains load path alignment
- Works in conjunction with guide rail
- Adjustable for user and load variations

NOTES

- Load-rated component
- Impact resistant
- Serviceable and replaceable
- Designed for dynamic use

MATERIAL KEY (M)

M6 25 mm Nylon Webbing Black

HARDWARE KEY (H)

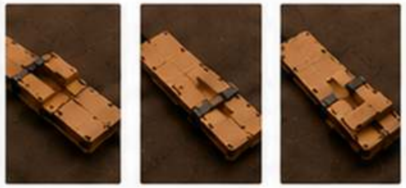
M8 ITW NEXUS LADDER LOCK 25mm Black

ITW NEXUS LADDER LOCK 25mm Black

KEY SPECIFICATIONS

Webbing Width (WW)	25 mm
Webbing Thickness (WT)	2.0 mm
Adjuster Type	ITW Nexus Ladder Lock 25mm
Adjuster Width (AW)	25 mm
Adjuster Height (AH)	20 mm
Slot Width (SW)	25 mm
Slot Height (SH)	4.5 mm
Adjusted Length Range	80 – 260 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	24 g
Operating Temp.	-20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)



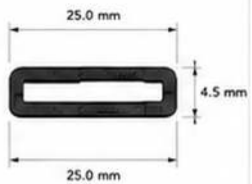
1. Slot adjuster simulates tension range.
2. Tape reinforcement simulates stitching.
3. End tabs simulate attachment points.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW



MOUNTED VIEW

TOLERANCES

Webbing Width (WW)	±0.3 mm
Webbing Thickness (WT)	±0.2 mm
Adjuster Width (AW)	±0.3 mm
Adjuster Height (AH)	±0.3 mm
Slot Width (SW)	±0.2 mm
Slot Height (SH)	±0.2 mm
Stitching Position	±1.0 mm

HARDWARE REFERENCE

M8 ITW NEXUS LADDER LOCK 25mm BLACK

M8 ITW NEXUS LADDER LOCK 25mm BLACK

COMPATIBILITY

- Interfaces with A2 (Rail / Guide Channel)
- Interfaces with A3 (Load Body Assembly)
- Works with A5 (Inward Tether) for load path
- Works with A7 (Hip Belt Assembly) for secondary load stabilization and user interface

MOVEMENT / FUNCTION SEQUENCE

1. NEUTRAL Strap at rest, no tension applied.

2. TENSION APPLIED User pulls strap inward to apply tension.

3. LOAD STABILIZED Tension reduces sway and stabilizes load against body.

4. LOCKED POSITION Adjuster locks strap length and maintains tension under load.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Ladder lock provides secure, low-profile adjustment.
- Webbing selected for strength, low stretch, and abrasion resistance.
- Bartack stitching prevents slippage and ensures joint integrity.
- Slot geometry in ladder lock is optimized for 25 mm webbing.
- Materials are corrosion resistant and UV stable.
- Assembly is serviceable and replaceable in the field.

- Maintain consistent tension without over-constraining movement.
- Keep adjuster accessible yet low profile.
- Prevent strap drift during dynamic use.
- Ensure smooth webbing path through rail.
- Optimize for strength-to-weight ratio.
- Minimize bulk while maintaining durability.

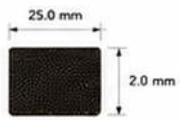
NOTES (ABOUT THIS COMPONENT)

The tension strap system applies adjustable inward tension to stabilize the load body and maintain an efficient load path. It works with the rail / guide channel and inbound tether to minimize sway, reduce leverage, and improve comfort. Designed for durability, smooth operation, and field reliability.

DIMENSIONS (PRODUCTION OBJECT)

LADDER LOCK (M8)

WEBBING (M6)



DOCUMENT INFO

Component ID	A6		
Document ID	ECS–A6–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A7 HIP BELT ASSEMBLY

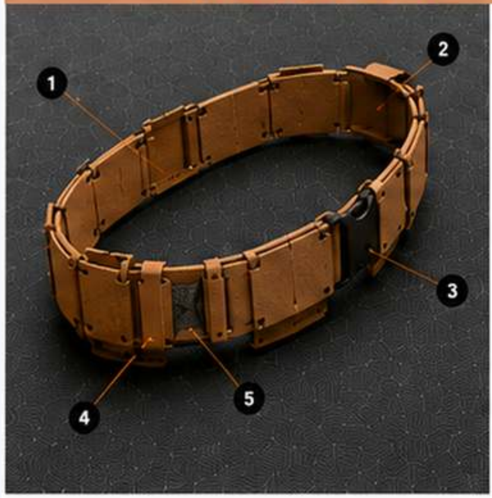
LOAD TRANSFER + SUPPORT + COMFORT CONTROL

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard
- Foam sheet (EVA)
- Tape reinforcement
- Plastic side release buckle
- Hot glue joints

FUNCTION

- Transfers load to hips
- Provides wrap and support
- Stabilizes load body
- Improves comfort and ventilation

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

1. Material: Belt: 500D Nylon + PU (M1) Padding: Closed-Cell Foam (M2) + 3D Spacer Mesh (M3)
2. Buckle: Side Release Low Profile (M8) Attachment: Bartack stitching
3. Function: Supports load on hips and improves comfort

FUNCTION

- Transfers load from harness to hips
- Distributes load across hip bones
- Stabilizes system under movement
- Enhances comfort and breathability
- Works with tether and tension system

NOTES

- Load-rated component
- Impact resistant
- Serviceable and replaceable
- Designed for dynamic use

MATERIAL KEY (M)

M1	500D Nylon + PU Black
M2	Closed-Cell Foam Black
M3	3D Spacer Mesh Black
M4	Side Release Low Profile Black

HARDWARE KEY (H)

M8	Side Release Low Profile Black

KEY SPECIFICATIONS

Belt Width (BW)	100 mm (tapered)
Padding Thickness (PT)	12 mm
Webbing Width (WW)	25 mm
Buckle Type	Side Release Low Profile
Adjustment Type	ITW Nexus Ladder Lock 25mm
Belt Size Range	760 – 1200 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	109 g
Operating Temp.	–20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)

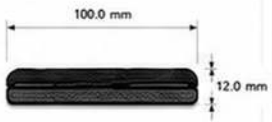
1. Cardboard strips form belt structure.
2. Foam padding simulates hip comfort layer.
3. Tape + buckle simulate attachment and closure.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW



MOUNTED VIEW

TOLERANCES

Belt Width (BW)	±2.0 mm
Padding Thickness (PT)	±1.0 mm
Webbing Width (WW)	±0.3 mm
Belt Length	±5.0 mm
Stitching Position	±1.0 mm
Buckle Alignment	±1.0 mm

HARDWARE REFERENCE

M8
SIDE RELEASE
LOW PROFILE
BLACK

COMPATIBILITY

- Interfaces with A3 (Load Body Assembly)
- Works with A5 (Inward Tether) for load path Works with A4 (Low Pivot Assembly)
- Works with A6 (Tension Strap System) for stabilization
- Supports dynamic load transfer to hips

MOVEMENT / FUNCTION SEQUENCE

1. NEUTRAL — Belt sits in neutral position around hips.
2. LOAD APPLIED — Load transfers from harness to hip belt.
3. STABILIZATION — Belt stabilizes system and reduces sway.
4. DYNAMIC SUPPORT — Belt maintains support during movement and posture change.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Wide belt design spreads load across hip bones.
- Closed-cell foam improves comfort and presses distribution.
- Spacer mesh enhances airflow and reduces heat buildup.
- Low-profile buckle minimizes bulk and improves mobility.
- Bartack stitching at critical points prevents failure.
- Materials selected for strength, abrasion resistance, and comfort.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

- Maintain consistent width for predictable load transfer.
- Minimize edge binding on hips.
- Ensure ventilation for extended wear.
- Balance stiffness and flexibility for comfort and control.
- Keep buckle low profile to avoid interference.
- Optimize padding thickness for support without bulk.
- Accommodate a wide range of body sizes.
- Minimize weight while maintaining durability.

NOTES (ABOUT THIS COMPONENT)

The hip belt assembly is the primary interface for transferring load from the harness to the user's hips. It provides structural support, stability, and comfort during dynamic movement. Designed for durability, ventilation, and field reliability.

DIMENSIONS (PRODUCTION OBJECT)

SECTION (PT)

DOCUMENT INFO

Component ID	A7		
Document ID	ECS–A7–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A8 STERNUM STABILIZER

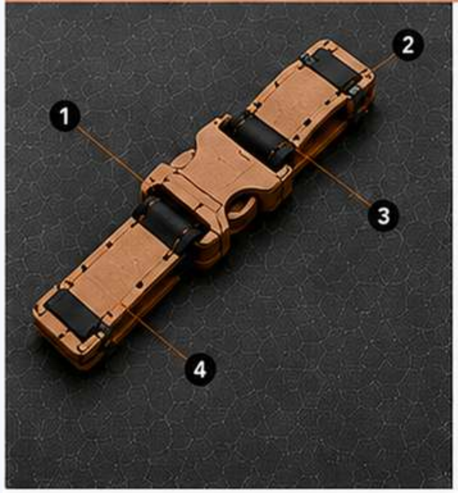
SHOULDER STRAP SPREAD CONTROL + SYSTEM STABILITY

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Cardboard strip
- Tape reinforcement
- Plastic side release buckle
- Hot glue joints

FUNCTION

- Controls shoulder strap spread
- Maintains harness alignment
- Stabilizes system under load
- Improves fit and reduces sway

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 25 mm Nylon Webbing (M6)
- Buckle: Low-Profile Side Release (M8)
- Adjuster: ITW Nexus Ladder Lock 25mm (M8)
- Attachment: Bartack stitching
- Function: Stabilizes shoulder strap spread for system stability under load

FUNCTION

- Keeps shoulder straps positioned over chest load path
- Prevents straps from collapsing inward
- Improves stability during movement
- Reduces fatigue and improves comfort

NOTES

- Load-rated component
- Impact resistant
- Serviceable and replaceable
- Designed for dynamic use

MATERIAL KEY (M)

	M6	25 mm Nylon Webbing Black
	M8	Low Profile Side Release Buckle Black
	M8	ITW Nexus Ladder Lock 25mm Black

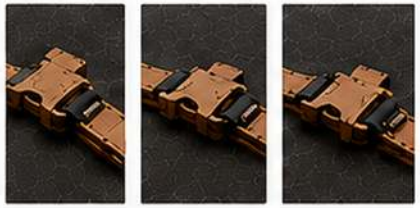
HARDWARE KEY (H)

	M8	Low Profile Side Release Buckle Black
	M8	ITW Nexus Ladder Lock 25mm Black

KEY SPECIFICATIONS

Webbing Width (WW)	25 mm
Webbing Thickness (WT)	2.0 mm
Buckle Type	Side Release Low Profile
Adjuster Type	ITW Nexus Ladder Lock 25mm
Adjuster Width (AW)	25 mm
Adjuster Height (AH)	20 mm
Buckle Width	28 mm
Buckle Height	18 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	16 g
Operating Temp.	−20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)



1. Cardboard strip forms webbing.
2. Tape reinforcement simulates stitching.
3. Buckle simulates stabilization function.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW

MOUNTED VIEW

TOLERANCES

Webbing Width (WW)	±0.3 mm
Webbing Thickness (WT)	±0.2 mm
Adjuster Width (AW)	±0.3 mm
Adjuster Height (AH)	±0.3 mm
Buckle Width	±0.3 mm
Buckle Height	±0.3 mm
Stitching Position	±1.0 mm

HARDWARE REFERENCE

M8 LOW PROFILE SIDE RELEASE BUCKLE BLACK

M8 ITW NEXUS LADDER LOCK 25mm BLACK

COMPATIBILITY

- Interfaces with A1 (Upper Harness Anchor)
- Interfaces with A2 (Rail / Guide Channel)
- Works with A5 (Inward Tether)
- Supports dynamic load transfer to hips

MOVEMENT / FUNCTION SEQUENCE

1. **NEUTRAL** Shoulder straps in natural position.
2. **SPREAD CONTROL** Stabilizer maintains set strap spread.
3. **LOAD APPLIED** System remains aligned under increasing load.
4. **MOVEMENT STABILITY** Prevent strap collapse and maintain alignment.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Stabilizer limits excessive shoulder strap spread for optimal biomechanics.
- Prevents inward strap collapse under load and during dynamic movement.
- Low-profile design reduces interference and improves comfort.
- Bartack stitching at critical points for strength and durability.
- Webbing selected for strength, low stretch, and abrasion resistance.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

- Maintain correct strap spread to improve load distribution and reduce fatigue.
- Keep profile low to avoid interference with gear and movement.
- Ensure buckle is centered and tensioned for consistent performance.
- Optimize stitching pattern for strength without adding bulk.
- Accommodate a wide range of body sizes and harness configurations.
- Minimize weight while maintaining durability.

NOTES (ABOUT THIS COMPONENT)

The sternum stabilizer is critical for maintaining shoulder strap geometry and system stability. It prevents the shoulder straps from spreading outward or collapsing inward, ensuring efficient load transfer, improved comfort, and reduced fatigue during extended use. Designed for durability, low profile, and dynamic field performance.

DIMENSIONS (PRODUCTION OBJECT)

BUCKLE (M8)

ADJUSTER (M8)

DOCUMENT INFO

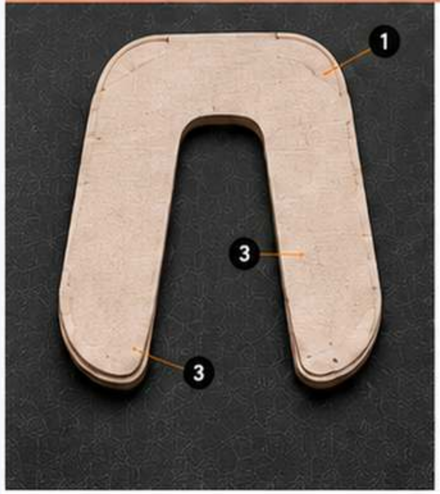
Component ID	A8		
Document ID	ECS–A8–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A9 BACK PANEL COMFORT PAD

VENTILATION + PRESSURE DISTRIBUTION + BACK COMFORT

REVISION: R1 | DATE: 25–05–18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Foam sheet (EVA)
- Tape attachment
- Hot glue joints

FUNCTION

- Tests back comfort zones
- Evaluates ventilation gaps
- Validates pressure distribution
- Simulates pack interface

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 3D Spacer Mesh (M3)
- Padding: Closed-Cell Foam (M2)
- Backing: 500D Nylon + PU (M1)
- Attachment: Bartack stitching

FUNCTION

- Improves airflow and ventilation
- Distributes load across back panel
- Reduces pressure points
- Enhances long term comfort
- Supports upright and dynamic use

NOTES

- Load-distributing component
- Impact resistant
- Serviceable and replaceable
- Designed for durability and comfort

MATERIAL KEY (M)


M3 3D Spacer Mesh Black


M2 Closed-Cell Foam Black


M1 500D Nylon + PU Black

HARDWARE KEY (H)


— Bartack Stitching High Tenacity Thread Black / Orange

KEY SPECIFICATIONS

Overall Height (OH)	460 mm
Overall Width (OW)	270 mm
Thickness (max)	12 mm
Ventilation Channel Width	60 mm
Foam Thickness	8 mm
Mesh Stand-Off	4 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	110 g
Operating Temp.	–20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

PROTOTYPE DETAILS (REFERENCE)


1. Foam sheet cutout forms basic shape.

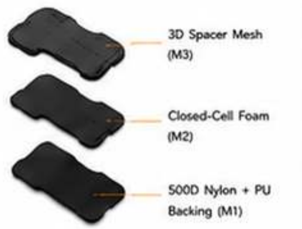

2. Tape simulates attachment zones.


3. Foam simulates comfort layer.

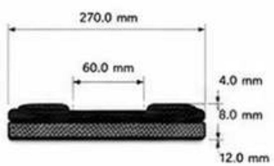
PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW



SECTION VIEW (THICKNESS)



MOUNTED VIEW

TOLERANCES

Overall Height (OH)	±2.0 mm
Overall Width (OW)	±2.0 mm
Thickness (max)	±0.3 mm
Channel Width	±1.0 mm
Foam Thickness	±0.5 mm
Mesh Stand-Off	±0.5 mm
Stitching Position	±1.0 mm

HARDWARE REFERENCE


— BARTACK STITCHING HIGH TENACITY THREAD BLACK / ORANGE

COMPATIBILITY

- Interfaces with A3 (Load Body Assembly)
- Interfaces with A7 (Hip Belt Assembly)
- Works with A6 (Tension Strap System)
- Compatible with ECS harness system
- Supports ventilation and pressure distribution

MOVEMENT / FUNCTION SEQUENCE


1. AIRFLOW 3D mesh promotes air circulation.


2. LOAD DISTRIBUTION Evenly spreads load across back area.


3. PRESSURE REDUCTION Contours reduce pressure points on the spine.


4. COMFORT & SUPPORT Improves comfort during extended carry.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- 3D mesh maintains airflow and reduces heat.
- Closed-cell foam provides comfort and load spread.
- U-channel relieves pressure along the spine.
- Tapered edges reduce interference and abrasion.
- Lightweight design maintains structural support.
- Materials selected for durability and field use.
- All materials are breathable and quick drying.
- Assembly is serviceable and replaceable in field.

DESIGN CONSIDERATIONS

- Optimize ventilation without sacrificing support.
- Maintain low profile to reduce bulk.
- Ensure compatibility with harness geometry.
- Provide consistent comfort over long durations.
- Prevent pressure points and chafing.
- Balance stiffness and flexibility.
- Resist compression set over time.
- Minimize weight while maximizing durability.

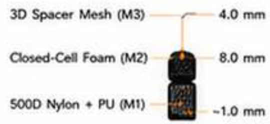
NOTES (ABOUT THIS COMPONENT)

The back panel comfort pad improves ventilation, distributes load, and reduces pressure points on the back. The 3D spacer mesh creates an air channel for cooling, while the foam layer spreads load evenly. The center channel relieves pressure along the spine. Designed for comfort, durability, and field reliability.

DIMENSIONS (PRODUCTION OBJECT)

VENTILATION CHANNEL DETAIL

MATERIAL STACK (SECTION)



DOCUMENT INFO

Component ID	A9		
Document ID	ECS–A9–ISO–01–R1		
Revision	R1	Scale	NTS (mm)
Date	25–05–18	Prepared By	ECS Design Team

A10 ACCESSORY / ATTACHMENT INTERFACE

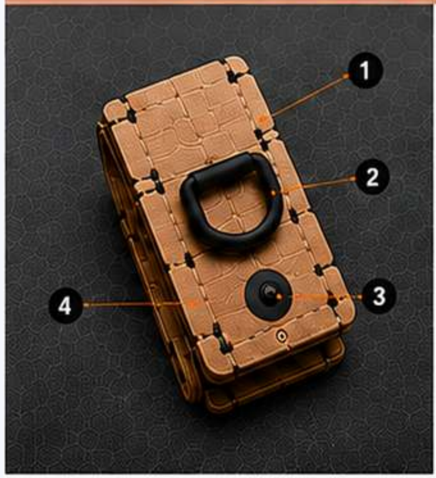
MODULAR ATTACHMENT + ACCESSORY INTEGRATION POINT

THE ERGONOMIC CARRY SYSTEM

PROTOTYPE → PRODUCTION TRANSLATION

REVISION: R1 | DATE: 25—05—18 | SCALE: NTS | UNITS: mm

TEST OBJECT (CARDBOARD PROTOTYPE)



MATERIAL

- Corrugated cardboard (3–5 mm)
- Tape reinforcement
- Hot glue joints

FUNCTION

- Tests accessory attachment location and security
- Validates load transfer to harness structure
- Evaluates rotation and retention
- Confirms user accessibility

NOTES

- Prototype simplification
- Not load rated
- Edge wear in testing

PRODUCTION OBJECT (DESIGNED INTENT)

CONSTRUCTION

- Material: 25 mm Nylon Webbing (M6)
- Hardware: D-Ring / Cord Pull Rivet (M8, M10)
- Attachment: Bartack + Rivet
- Finish: Clean edge, sealed

FUNCTION

- Provides secure accessory attachment point
- Transfers load to harness structure
- Supports tethering and modular accessories
- Allows quick access and removal

NOTES

- Load-rated component
- Impact resistant
- Serviceable and replaceable
- Designed for dynamic use

MATERIAL KEY (M)

	M6	25 mm Nylon Webbing Black
	M8	D-Ring / Cord Pull Black
	M10	Rivet / Screw Black Oxide

HARDWARE KEY (H)

	M8	ITW Nexus D-Ring 25mm Black
	M10	Acetal / POM Rivet / Screw Black

KEY SPECIFICATIONS

Webbing Width (WW)	25 mm
Webbing Thickness (WT)	2.0 mm
Length (Overall) (OH)	90 mm
Width (Overall) (OW)	50 mm
Attachment Type	Bartack + Rivet
Rivet Diameter (Ø)	12 mm
Rivet Height	4.5 mm
D-Ring Size (Internal)	25 mm
Load Rating (per assembly)	> 2.0 kN
Weight (approx.)	28 g
Operating Temp.	−20 °C to +60 °C
Corrosion Resistance	5% Salt Spray 48 hr min.

TEST OBJECT DETAILS (REFERENCE)

1. Tab simulates attachment location.

2. Tape simulates reinforcement and load path.

3. Hot glue simulates rivet and retention point.

PRODUCTION DETAILS

ISOMETRIC (ASSEMBLED)

EXPLODED VIEW

SECTION VIEW

MOUNTED VIEW

TOLERANCES

Overall Length (OH)	±2.0 mm
Overall Width (OW)	±1.0 mm
Webbing Thickness (WT)	±0.2 mm
Rivet Diameter (Ø)	±0.2 mm
Rivet Height (RH)	±0.2 mm
D-Ring Size (ID)	±0.5 mm
Stitching Position	±1.0 mm

HARDWARE REFERENCE

M8
ITW NEXUS
D-RING 25mm
BLACK

M10
ACETAL / POM
RIVET / SCREW
BLACK

COMPATIBILITY

- Interfaces with A1 (Upper Harness Anchor)
- Interfaces with A3 (Load Body Assembly)
- Interfac with A7 (Tension Strap System)
- Compatible with ECS harness system
- Supports modular accessories and quick removal

MOVEMENT / FUNCTION SEQUENCE

1. NEUTRAL — Interface sits flat against harness.
2. ACCESSORY ATTACHED — Accessory connected to D-ring or tether.
3. LOAD TRANSFER — Load distributed through interface to harness.
4. REMOVABLE — Accessory removed quickly and easily.

INTERFACES (CONNECTIONS TO OTHER COMPONENTS)

ENGINEERING NOTES

- Rivet provides secure, low-profile retention with high pull-out resistance.
- D-ring allows attachment of pouches, tools, and tether systems.
- Webbing selected for strength, low stretch, and abrasion resistance.
- Bartack stitching at critical points prevents failure and tearing.
- Low-profile design reduces snag risk and improves comfort.
- Assembly is serviceable and replaceable in the field.

DESIGN CONSIDERATIONS

- Maintain easy access without interfering with movement.
- Ensure load path aligns with harness structure.
- Prevent twisting or rotation under load.
- Optimize placement for balance and usability.
- Use corrosion resistant hardware for durability.
- Minimize bulk while maximizing strength.

NOTES (ABOUT THIS COMPONENT)

The accessory / attachment interface provides a secure and modular integration point for accessories, tools, and tethering systems. It transfers load safely to the harness, supports quick access and removal, and maintains a low-profile design for comfort and unobstructed movement. Designed for durability, compatibility, and field reliability.

TEST OBJECT DIMENSIONS (REFERENCE)

PRODUCTION DIMENSIONS (DESIGNED INTENT)

HARDWARE DIMENSIONS (REFERENCE)

D-RING (M8)

RIVET / SCREW (M10)

DOCUMENT INFO

Component ID	A10		
Document ID	ECS—A10—ISO—01—R1		
Revision	R1	Scale	NTS (mm)
Date	25—05—18	Prepared By	ECS Design Team

05

ASSEMBLY

THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

ECS-MT-03-R1 | SYSTEM ASSEMBLY & INTEGRATION

HOW COMPONENTS A1–A10 COMBINE INTO THE COMPLETE ERGONOMIC CARRY SYSTEM (ECS)

05 | ASSEMBLY

SYSTEM ASSEMBLY / COMPONENT INTEGRATION

This page illustrates how all validated components integrate to form the complete Ergonomic Carry System (ECS).

Dashed lines indicate assembly paths. The orange line shows the primary load path through the system.

ASSEMBLY SEQUENCE

1. Install A2 (Rail) onto A3 (Load Body) stainless steel hardware
2. Install A9 (Back Panel Pad) onto rear face of A3.
3. Install A4 (Low Pivot) onto rail assembly at hip level.
4. Route A5 (Inward Tether) through guide path in A4 and A2.
5. Install A6 (Tension Strap System) through A4 and align.
6. Attach A1 (Upper Harness Anchor) to top of A2.
7. Attach A7 (Hip Belt Assembly) to A4 pivot points.
8. Attach A8 (Sternum Stabilizer) to shoulder straps.
9. Install A10 (Accessory Interface) at desired mount point.

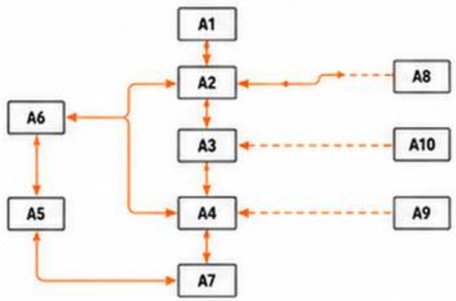
INTERFACE MATRIX

A1	Upper Harness Anchor	⟷	A2	Rail / Guide Channel
A1	Upper Harness Anchor	⟷	A10	Accessory Interface
A2	Rail / Guide Channel	⟷	A3	Load Body Assembly
A2	Rail / Guide Channel	⟷	A4	Low Pivot Assembly
A3	Load Body Assembly	⟷	A9	Back Panel Comfort Pad
A3	Load Body Assembly	⟷	A10	Accessory Interface
A4	Low Pivot Assembly	⟷	A5	Inward Tether
A5	Inward Tether	⟷	A6	Tension Strap System
A6	Tension Strap System	⟷	A7	Hip Belt Assembly
A6	Tension Strap System	⟷	A8	Sternum Stabilizer
A7	Hip Belt Assembly	⟷	A10	Accessory Interface

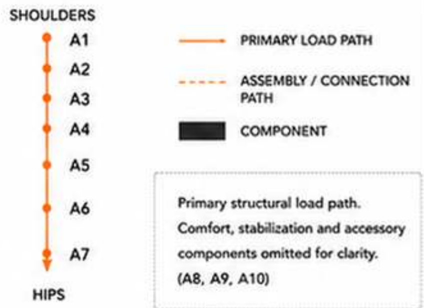
HARDWARE SUMMARY (PER SYSTEM)

ID		HARDWARE COMPONENT	QTY
	M8	ITW NEXUS LADDER LOCK 25mm	QTY: 6
	M9	GF NYLON PIVOT PIN / BRACKET	QTY: 2
	M10	ACETAL / POM WASHER / BEARING	QTY: 4
	M11	ITW NEXUS SIDE RELEASE 25mm	QTY: 3
	M12	ITW NEXUS TRI-GLIDE ADJUSTER 25mm	QTY: 8

SYSTEM ARCHITECTURE (CONNECTION FLOW)



LOAD PATH (PRIMARY)



Primary structural load path. Comfort, stabilization and accessory components omitted for clarity. (A8, A9, A10)

COMPONENT SUMMARY (A1–A10)

ID	COMPONENT	FUNCTION
A1	Upper Harness Anchor	Upper load transfer
A2	Rail / Guide Channel	Guided vertical motion
A3	Load Body Assembly	Structural load platform
A4	Low Pivot Assembly	Articulation at hip level
A5	Inward Tether	Inward pull and control
A6	Tension Strap System	System stabilization
A7	Hip Belt Assembly	Transfers load to hips
A8	Sternum Stabilizer	Shoulder strap control
A9	Back Panel Comfort Pad	Comfort and ventilation
A10	Accessory Interface	Modular attachment point

SYSTEM PRINCIPLE

The harness is a passive mechanism that works with the body, not against it.

Load follows posture.
The structure follows load.

06

REFLECTION

THE ERGONOMIC CARRY SYSTEM

A wearable load-transfer system for urban e-bike commuters

Designed for movement beyond the ride.
The system transitions naturally between cycling and pedestrian contexts, maintaining comfort, stability, and everyday usability throughout the commute.

The project began as a backpack.
It resolved into a load path.

The harness is a passive mechanism.

The pack is the geometry, given a body.

What comes next is not a product.
It is the same method, applied to
the next problem worth carrying.