LONGBOW HORSEMAN ENTERPRISE

Farm • Fiber • Composites

Integrated Business Plan

Christopher D. Iorg

Box Elder County, Utah

longbowhorseman@gmail.com

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Executive Summary

The Longbow Horseman Enterprise is a vertically integrated agricultural and advanced manufacturing business based in Box Elder County, Utah. It is built on a single, powerful insight: industrial hemp is the most versatile industrial crop on earth, and the technology to convert it into high-performance structural composite materials — already proven with synthetic carbon fiber — can be adapted to run organic fiber inputs, opening a vast new market at the intersection of regenerative agriculture and advanced manufacturing.

This business operates across three fully integrated layers:

- Layer 1 — Regenerative Farm: A diverse, chemical-free farm operation growing industrial hemp as the primary cash crop alongside heritage animals (cattle, poultry, pigs) and complementary food crops, using rotational grazing and no-till soil practices that build land value over time.
- Layer 2 — Fiber Processing: On-site or contracted decortication and fiber preparation converting raw hemp stalks into bale fiber, hurd, and refined composite-ready fiber strands.
- Layer 3 — Composite Manufacturing: Impregnating, shaping, and curing hemp fiber into structural composite parts — construction panels, pipe sections, automotive panels, and eventually marine and aerospace-grade continuous sheet — for sale to industrial buyers.

The founder brings a rare combination of qualifications to this venture: years of hands-on experience manufacturing precision composite parts for the F-35 fighter jet and other high-end defense applications, combined with a working farm background that includes annual cattle drives into Ashley Forest. He already understands the process chemistry, tooling, and quality standards required for structural composite manufacturing. The core insight is that the same machines currently producing carbon fiber composite shapes can be modified to accept hemp fiber — a modification that is technically straightforward and economically transformative.

> **Market Opportunity:** *Hemp fiber composites were valued at $380M globally in 2024 and are projected to reach $1.28B by 2031, growing at 18.9% CAGR. Hemp fiber itself is a $11.18B market in 2026 projected to reach $46.8B by 2033 at 22.7% CAGR. The U.S. currently dominates North American production.*

The total addressable market across four end-use sectors — infrastructure pipe, construction panels, automotive parts, and marine/aerospace — exceeds $400 billion annually. Even a fraction of a percent of penetration in any single category represents transformational revenue.

Section 1: Regenerative Farm Operations

1.1 Philosophy and Approach

The Longbow Horseman farm operates on a simple principle: healthy soil grows healthy plants, healthy plants feed healthy animals, and healthy animals give back to the soil. Every practice chosen — from animal rotation to cover cropping to composting — is designed to build the land rather than deplete it. Chemical inputs and excessive tillage are rejected not as ideology but as economics: soil biology is the farm's primary long-term asset, and destroying it with synthetics is the same as burning your factory floor.

This approach aligns directly with the growing regenerative agriculture movement, which is now commanding premium pricing from food buyers, carbon credit markets, and input-cost savings that dramatically improve farm margins over time.

> **From research:** *Farmers who rotate hemp with other crops see a 10–15% yield increase in subsequent crops from hemp's deep taproot breaking up hardpan soil. This 'Hemp Bump' adds $50–$100 of value to every acre in rotation. (Dakota Hemp, 2026)*

1.2 Land and Location

The farm is located in Box Elder County, Utah. The operation currently encompasses an existing working farm with heritage livestock and established fencing, irrigation access, and infrastructure. The arid high-desert climate presents specific management considerations but also advantages: low pest pressure, low disease pressure, and excellent growing conditions for hemp fiber varieties when irrigation is managed correctly.

Target operating acreage for hemp production begins at 20–50 acres in Phase 1, scaling to 150+ acres as processing infrastructure is established and offtake contracts secured.

1.3 Animals and Rotational Integration

The animal component of the farm serves multiple functions simultaneously: soil fertility, pest management, product diversity, and cash flow stability. The following species are planned or in operation:

- Cattle (heritage breeds): Primary grazing herd. Rotated through paddocks on 21-28 day rest cycles using managed intensive grazing. Cattle deposit fertility and break soil compaction. Calves represent annual cash income. Summer cattle drives into Ashley Forest continue the existing tradition.
- Poultry (chickens): First flock already raised (2023). Mobile coops follow cattle rotation, scratching through manure, eliminating fly larvae, and depositing concentrated nitrogen fertility. Eggs provide direct market income and personal/farm nutrition.
- Pigs: Root and till natural areas where needed, converting waste grain and food scraps into high-value protein. Pigs can be integrated into hemp stalk retting areas to assist decomposition.
- Additional species under consideration: sheep (dual-purpose wool/meat, excellent hemp field post-harvest grazing), ducks (pond/irrigation canal management), bees (pollination services, honey income).

1.4 Crop Rotation and Grazing Strategy

The farm employs a planned rotation across hemp, cover crops, and animal grazing that rebuilds soil at every phase:

1.5 Hemp Cultivation — Primary Cash Crop

Industrial hemp is selected as the primary cash crop for four reasons: (1) it is the highest-revenue non-floral open-field crop per acre when sold as refined composite-ready fiber, (2) it dramatically improves soil health over time, (3) it is the direct feedstock for the composite manufacturing business at the farm's core, and (4) regulatory clarity has improved substantially since the 2018 Farm Bill, with Utah issuing licenses through the Utah Department of Agriculture.

Variety Selection

Fiber hemp varieties (not CBD/floral) are the target — specifically long-stalk varieties with high bast fiber content, suitable for decortication and composite manufacturing. European varieties (Futura 75, Fedora 17) and emerging U.S. varieties are candidates. Seed sourcing will be from licensed suppliers with documented genetics.

Yield and Revenue Projections (Fiber)

> **Key Insight:** *The path to premium pricing is not selling raw stalk — it is selling processed, composite-ready fiber direct to manufacturers. Every processing step retained on-farm dramatically increases margin per pound.*

Section 2: Fiber Processing

2.1 From Stalk to Fiber — The Process

Hemp fiber processing transforms raw harvested stalks into usable industrial fiber through a series of steps that the farm can perform in-house (partial or full) or contract to a regional processor:

- Harvesting: Hemp stalks are cut at the base using a sickle bar cutter or modified combine. Timing matters — harvesting at early flowering produces optimal long bast fiber.
- Retting: Cut stalks are left in the field (dew retting) or placed in water (water retting) for 2–4 weeks, allowing microbial action to partially separate the fiber from the woody core (hurd). Retting quality directly determines fiber strength and color.
- Decortication: Retted stalks are run through a decorticator — a machine that separates bast fiber from hurd using rollers and beaters. This is the primary capital equipment investment of Phase 2.
- Fiber Separation and Cleaning: Long bast fibers are separated from short fibers and hurd. Long bast fiber is the high-value composite input. Short fiber and hurd are sold as secondary revenue streams (animal bedding, hempcrete aggregate, paper pulp).
- Baling and Grading: Clean long fiber is baled, graded for quality (length, fineness, cleanliness), and stored or shipped to composite manufacturing.

2.2 Revenue Streams from Processing

2.3 Phase 2 Capital Equipment

A small-scale decorticator suitable for 20–50 acre farm production costs approximately $50,000–$150,000 new, or can be sourced used/refurbished in the $20,000–$60,000 range. At 50 acres of production, on-site processing is strongly preferred over contract processing, both for margin control and for maintaining the fiber quality standards required by composite manufacturing.

Section 3: Hemp Fiber Composite Manufacturing

3.1 The Core Innovation

This section represents the highest-value, most technically differentiated part of the Longbow Horseman business. The founder's background manufacturing precision parts for the F-35 fighter jet and other defense applications is the key differentiator — he understands not just that this is possible, but the specific tooling modifications, process controls, and quality standards required to make it work commercially.

The central insight is straightforward: the industrial machines currently producing carbon fiber composite parts — pultrusion lines, compression molding presses, filament winders, resin transfer molds — can be modified to accept hemp fiber instead of carbon or glass fiber. Hemp fiber is a sustainable, domestically grown, cost-competitive alternative that produces composite parts with excellent structural properties for many applications, and with unique additional properties (bioelectrical conductivity, natural flexibility, moisture management) that synthetic fibers cannot match.

> **Competitive positioning:** *The U.S. currently produces almost no structural natural fiber composites at scale. The market is dominated by synthetic carbon fiber and fiberglass. This is a gap, not a barrier — and it represents first-mover advantage for a domestic producer with manufacturing expertise.*

3.2 Hemp as a Structural Material — Technical Properties

3.3 Impregnation and Manufacturing Process

Hemp fiber is converted into a structural composite through matrix impregnation — coating or saturating the fiber strands with a binding material (resin, silicone, geopolymer, or bio-based polymer) that locks the fibers into a rigid structural matrix when cured. The specific impregnation element chosen determines the final properties of the part:

- Epoxy resin: Highest strength, used for structural panels, automotive exterior, aerospace-grade applications. Standard process; existing carbon fiber tooling applies directly.
- Polypropylene (PP) matrix: Thermoplastic, recyclable, good for automotive interior panels, construction decking. Compression molding process.
- Silicone impregnation: Outstanding flexibility retention, chemical resistance, and UV stability. Ideal for pipe applications — a silicone-impregnated hemp fiber pipe is more flexible than steel, corrosion-proof, and can integrate monitoring capabilities.
- Geopolymer/cement matrix: For construction panels and hempcrete structural elements. Lower tech, lower cost, enormous volume potential.
- Bio-based resins (PLA, chitosan): Fully biodegradable end-of-life. Emerging but technically proven at research scale.

3.4 Embedded Monitoring Capability

Hemp's natural supercapacitor properties — its ability to store and conduct electrical charge through the fiber structure — enable a capability that synthetic composites do not have without expensive additions: embedded electrical monitoring. By running conductive elements through hemp fiber composite pipe or structural panels during manufacturing, the finished part can carry continuous electrical signals that report on:

- Structural stress and deformation (strain gauge function)
- Moisture ingress (capacitance change detection)
- Impact damage (signal disruption)
- Flow rate and pressure (pipe applications)

This monitoring capability is particularly valuable for large-scale continental pipeline infrastructure, where current inspection is expensive, dangerous, and intermittent. A hemp composite pipe that continuously reports its own structural condition over its full installed length represents a major advancement over steel or fiberglass alternatives.

Section 3B: First Responder Textiles — A New End Market

3B.1 The Problem with Current First Responder Uniforms

Law enforcement, fire, EMS, and military first responders currently wear uniforms manufactured almost entirely from synthetic polymer fibers — polyester, nylon, Nomex, and similar petroleum-derived materials. These materials share a set of serious, well-documented problems that the market has not yet solved:

- Forever chemical contamination: PFAS (per- and polyfluoroalkyl substances) are embedded in most synthetic uniform fabrics for water and stain resistance. These chemicals do not break down in the body or environment, have been linked to cancers, hormonal disruption, and immune dysfunction, and are currently the subject of major litigation against gear manufacturers and governmental health investigations.
- No structural body armor qualification: Standard duty uniforms — pants, duty shirts, pullovers — are not rated or designed to meet structural body armor requirements, despite being worn in high-risk physical confrontation environments. A first responder's everyday uniform provides essentially no ballistic or blunt-force protection beyond the fabric itself.
- Heat and moisture management failure: Synthetic fibers trap heat and moisture, contributing to heat illness — a leading cause of line-of-duty injuries especially among fire and EMS personnel.
- Environmental persistence: Synthetic polymer textiles shed microplastics with every wash, entering waterways and food chains. Departments face growing regulatory pressure to address this.

3B.2 The Hemp + Natural Fiber Solution

The Longbow Horseman Enterprise proposes a new category of first responder duty textile: a woven composite garment that combines industrial hemp fiber with complementary natural fibers and functional elements — wool, leather, and silicone — to produce superior protective clothing without the health and environmental risks of synthetic polymers.

The fiber inputs and their roles:

- Industrial hemp (primary structural fiber): High tensile strength (550-900 MPa), natural antimicrobial properties, excellent breathability, moisture-wicking, and rapid drying. Hemp fiber is the structural backbone of the garment. Its natural flexibility and toughness make it ideal for garments that must withstand physical stress.
- Wool (thermal and fire regulation): Natural wool is inherently flame-resistant without chemical treatment — it chars rather than melts, does not drip burning material, and self-extinguishes. Woven with hemp, wool provides the thermal regulation layer that synthetic Nomex attempts to replicate chemically. Wool can be sourced directly from on-farm sheep.
- Leather (impact and abrasion zones): Reinforcing panels at high-wear and high-impact locations — knees, elbows, shoulders, holster areas — using vegetable-tanned leather provide durability and impact resistance far exceeding any woven synthetic at these stress points.
- Silicone impregnation (water repellency and structural stiffening): Instead of PFAS-based water resistance, silicone is applied to the outer fiber layer. Silicone is food-grade safe, does not

bioaccumulate, provides excellent water repellency, and can be applied to reinforce structural panels within the garment to provide blunt-force resistance ratings.

- Conductive hemp thread (optional monitoring layer): Hemp's natural supercapacitor properties can be exploited in the garment itself — conductive threads woven into the duty uniform can carry biometric monitoring data (body temperature, heart rate, impact force) in real time to a department dispatch system.

3B.3 Structural Protection — Path to Body Armor Rating

Standard duty uniforms are not body armor and are not tested as such. However, the combination of woven hemp fiber composite panels, silicone structural impregnation, and leather reinforcement at critical zones can be designed and submitted for testing under NIJ (National Institute of Justice) standards for soft body armor and tactical garment protection. This is not a claim that hemp fabric equals ballistic-rated Kevlar — it is a claim that a properly engineered multi-fiber garment can meet protection standards that current synthetic duty uniforms completely fail to address, without the health risks of forever chemicals.

> **Market opportunity:** *The U.S. law enforcement and first responder uniform market exceeds $2 billion annually. Growing PFAS litigation against gear manufacturers, combined with EPA and state-level PFAS restrictions now taking effect, is creating urgent demand for non-synthetic alternatives that maintain or improve protective performance.*

3B.4 Why This Business Is Positioned to Build It

Most textile companies do not understand composite fiber engineering. Most composite manufacturers do not understand garment construction. The Longbow Horseman Enterprise understands both — and farms the primary raw material. The integration of on-farm hemp and wool fiber, composite manufacturing expertise from defense aerospace, and the P.L.U.R.R. mission of protecting the people who protect communities makes this product category a natural extension of every other part of this business.

Phase 3 target: Develop and test a prototype hemp-wool-leather-silicone duty pullover and duty pants. Partner with one law enforcement agency or fire department for real-world wear testing. Submit to NIJ for protective rating evaluation. Present as an alternative to PFAS-contaminated synthetic uniforms.

Section 4: End Markets and Revenue Potential

4.1 Infrastructure Pipe (Water and Gas)

The global pipeline market for water and gas infrastructure exceeds $60 billion annually. Current materials — steel, concrete, PVC, HDPE — each have significant drawbacks: corrosion, brittleness, cost of installation, inability to self-monitor. Hemp fiber composite pipe, impregnated with silicone or epoxy matrix, addresses all of these weaknesses.

> **Key advantages:** *Hemp fiber pipe is 6× more flexible than steel (easier to install around terrain), corrosion-proof, lighter weight (lower installation cost), and can embed real-time structural monitoring through its natural conductivity properties.*

Target applications: municipal water mains, agricultural irrigation, natural gas distribution, industrial process pipe. Phase 3 target: small-diameter prototype pipe sections (4–12 inch diameter) for pilot program with a municipal water authority or agricultural irrigation district.

4.2 Construction Panels (4×8 Sheets and Continuous Sheet)

The construction materials market is undergoing a sustainability transformation driven by green building codes, LEED certification requirements, and ESG-driven procurement by large developers. Hemp composite structural panels — the equivalent of OSB, plywood, or fiberglass-reinforced concrete panels — offer a fully renewable, domestically produced alternative.

The target product is a hemp fiber composite panel in standard 4×8 foot dimensions for drop-in compatibility with existing construction workflows, and continuous sheet production (roll-to-roll or large-format press) for shipbuilding, modular construction, and curved architectural applications.

- Structural wall and roof sheathing: Direct substitute for OSB. Hemp composite panels offer superior moisture resistance and comparable structural ratings.
- Hempcrete form panels: Permanent form-in-place panels for hempcrete pours, remaining structural after pour is set.
- Interior panels: Acoustic insulation and structural partitioning with natural fiber aesthetics.

The natural fiber composites construction segment is the largest end-use category, holding the dominant market share of the $9.44B global natural fiber composites market (Grand View Research, 2024).

4.3 Automotive Parts

The automotive industry is already using natural fiber composites at scale. BMW, Porsche, and Mercedes have all deployed hemp and flax composites in door panels, trunk liners, seat backs, and exterior body panels. The BMW M4 GT4 uses a body kit made entirely of natural fiber composites. The market is proven and growing — hemp is projected to be the fastest-growing material type in natural fiber composites at 12.8% CAGR.

The target entry point is aftermarket and specialty automotive parts — truck bed liners, interior panels, tonneau covers, and body kits — before pursuing Tier 2 or Tier 1 OEM supply chain positions. The founder's precision manufacturing background is directly applicable to the tolerance and quality requirements of automotive composite parts.

> **Market data:** *The global automotive natural fiber composites market is expected to register 9% CAGR 2024–2029. Vehicle weight reduction of up to 34% is achievable with NFC substitution. (Mordor Intelligence, 2025)*

4.4 Marine and Aerospace

Marine (shipbuilding) and aerospace represent the highest-specification, highest-margin end markets for structural composites. Both industries are under intense sustainability pressure — naval architects and aircraft engineers are actively seeking bio-based composite alternatives that can meet structural requirements without the carbon footprint of synthetic fiber.

Continuous hemp composite sheet — large-format panels produced in a continuous press process — is the target product for these markets. The founder's F-35 manufacturing background provides credibility and technical knowledge that most natural fiber composite producers cannot claim.

Timeline: Marine and aerospace applications are a Phase 4 target (Year 5+), requiring rigorous testing, certification, and partnership with a qualified naval architecture or aerospace engineering firm. The groundwork is laid in Phases 1–3 through establishing composite manufacturing capability and quality management systems.

Section 5: Financial Projections and Phased Growth

5.1 Phase Structure

The business is built in four distinct phases, each self-funding the next where possible, with targeted capital raises at Phase 2 and Phase 3 transitions:

5.2 Three-Year Projected Income Statement

Year 1 net: approximately break-even (~$1,000 loss). Year 2 net: investment year, ~$19,000 loss as processing equipment comes online and composite revenue begins. Year 3 net: first profitable year, ~$75,000 net income with composite manufacturing at scale.

5.3 Key Financial Assumptions

- Farm land is owned, not leased — eliminating the largest fixed cost that hampers most hemp startups.
- Processing is phased in with cash flow — no large upfront debt load.
- Offtake contracts for fiber will be sought before each planting season to reduce price risk.
- Composite prototype revenue in Year 2 comes from small-batch custom orders using existing manufacturing relationships from the founder's prior career.
- Carbon credit income assumes registration with a verified carbon program by end of Year 1 ($30–$60/acre sequestration credit).

Section 6: Competitive Advantage

6.1 What Makes This Different

The hemp composite market is nascent in the United States — most competitors are either farmers who grow hemp and sell raw fiber (low margin, commodity), or materials researchers who understand the chemistry but lack manufacturing scale-up experience. The Longbow Horseman Enterprise occupies a position that neither group can easily replicate:

- Manufacturing expertise: The founder has personally produced precision composite parts to defense aerospace standards. He knows tolerances, process controls, tooling design, and quality documentation requirements that academic researchers and commodity farmers simply do not have.
- Vertical integration: Growing the fiber, processing it, and manufacturing the final part on a single operation eliminates supply chain risk and captures margin at every stage.
- Regenerative credentials: As industrial buyers face increasing ESG pressure and new carbon regulations, a domestic, chemical-free, regeneratively grown fiber feedstock commands real premium pricing and preferred supplier status.
- Embedded monitoring IP: The application of hemp's natural supercapacitor properties to embed real-time structural monitoring in composite pipe represents genuine, patentable innovation with no direct commercial competitor today.
- Land ownership: Owning the farm land eliminates the fixed lease cost that is the single largest threat to hemp farm profitability identified in current industry analysis.

Section 7: Risks and Mitigation

- Hemp fiber price volatility (Medium): Lock in offtake contracts before each planting season; on-farm processing captures margin regardless of raw fiber price.
- Regulatory changes to hemp cultivation (Low-Medium): Box Elder County and Utah program are stable; diversified farm reduces single-crop exposure.
- Processing equipment capital requirement (Medium): Phase 2 entry timed to Phase 1 cash flow; used decortication equipment available in the $20K-$60K range.
- Market education for composite buyers (Medium): Lead with technical specifications, not the hemp story; target ESG-mandated buyers and government infrastructure programs first.
- Weather and drought risk (Medium-High): Rotational crops and heritage livestock provide cash flow baseline when any single crop underperforms.
- Processing moisture and quality variability (Medium): Invest in controlled retting protocols and graded fiber quality management from Phase 2 onward.

Section 8: Immediate Next Steps

Year 1 Priority Actions

- Apply for Utah Department of Agriculture industrial hemp grower license (if not already held).
- Source and contract fiber hemp seed variety suited to Utah climate and soil conditions.
- Establish offtake relationship with at least one regional fiber processor or composite manufacturer for Year 1 crop.
- Register farm with a verified carbon credit program.
- Begin documentation of soil health baseline (organic matter, biology, compaction) to track regenerative progress and qualify for premium pricing.
- Identify and begin conversations with one potential pilot customer in each of the four end markets (pipe, construction, automotive, marine).
- File provisional patent application on embedded-monitoring hemp composite pipe design.

Year 2 Priority Actions

- Purchase or contract access to a decortication line for on-farm processing.
- Produce first small-batch composite prototype panels and pipe sections for customer evaluation.
- Begin relationship with composite testing lab (ASTM certification of hemp composite properties).
- Expand hemp acreage based on contracted demand.

This is a generational business. The land gets stronger every year. The manufacturing capability builds on itself. The market is moving in the right direction. The founder is uniquely positioned to lead it.

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