**✅ Phase 1: Feature Breakdown by User Group**

**🟢 Active Users & Core Features**

| **User Type** | **MVP Features** |
| --- | --- |
| **Shippers** | - Create shipment contract (origin, destination, payload type)  - Upload documentation (PDF, NFT record optional)  - Track milestone fulfillment status  - Initiate disputes or reclaims |
| **National Carriers** | - Accept shipment contracts  - Report milestone completion (via webhook or REST API)  - Provide GPS + signature proof  - Get paid via smart contract trigger |
| **3PLs / Regionals** | - Join contract as subcontractor  - Submit proof-of-handoff  - Real-time updates to backend |
| **Freight Brokers** | - Create contracts on behalf of clients  - Monitor KPIs (ETA, SLA breach, delivery success rate)  - Tokenize documents (if needed) |
| **Warehouse/Fulfillment** | - Check-in/check-out handling  - Validate sensor metadata at packaging (temp, shock, seal) |
| **Customs / Govt (Pilot)** | - View immutable delivery data  - Optional smart contract approval before release |
| **Insurers** | - Receive sensor data logs via API  - Automate claims or premium adjustments  - Generate claims based on on-chain event signatures |

**🟡 Passive Users & Support Functions**

| **User Type** | **MVP Touchpoints** |
| --- | --- |
| **Recipients** | - View delivery confirmation link  - Optional NFT receipt |
| **IoT Vendors** | - Send webhook or publish MQTT → oracle event |
| **Legal/Compliance** | - View logs or contract execution receipts |
| **Agencies (USDOT/USPS)** | - Access sandbox environment or dashboard for program oversight |
| **Grant Reviewers** | - View milestone completion, on-chain events, dashboards |

**✅ Phase 2: Prioritized MVP Feature Set**

**🔹 V1 – Launch Core**

* Shipment creation (API/UI)
* Milestone contract on Arbitrum
* Carrier Webhook API
* Chainlink oracle simulation for GPS or temp data
* Wallet login (RainbowKit + wagmi)
* Delivery view + contract state
* PostgreSQL + Redis stack

**🟡 V2 – Enhanced Ops**

* NFT bill of lading (ERC-721)
* IoT gateway + MQTT ingestion
* Dispute arbitration via DAO or admin portal
* Event playback for insurance/legal
* IPFS document hashing

**🔵 V3 – Ecosystem + Compliance**

* Customs approval module
* Multi-party tokenized revenue splits (shippers, brokers)
* Regulatory compliance tags (CBP, FDA, USDOT)
* Analytics dashboard (SLAs, drops, location heatmaps)

**✅ Phase 3: Persona-Based Flowchart (Active Users)**

I’ll generate this next visually — it will map:

* **Actors** → contract actions
* **Data events** → blockchain/oracle/middleware interaction
* **End outcomes** (e.g. delivery verified → payment → NFT)

This is best delivered as a separate visual to match your architecture diagram.