The equipment needed to assemble a BUV is very simple, even small repair shops have many of the tools required. BUV assembly can occur almost anywhere, by almost anyone.

Design Objectives:
- Minimize total lifetime cost of ownership
- Utilize off-the-shelf components where possible to minimize part costs
- Employ simple, durable, low maintenance design
- Utilize as few as two people to assemble vehicle. Utilize Design For Assembly (DFA) methods
- Minimize machining, welding, and fixtures for Third World assembly to reduce investment/skill required
- Emphasize safety in all aspects of design. Protect driver and passengers from moving parts
- Emphasize reliability (repairing the vehicle in the field is very difficult due to remote location & poor infrastructure)

Other Requirements:
- Power unit must be bolted to the rear unit. All used parts must come from the same vehicle make
- Any parts of the salvaged car may be reused except the engine and unibody
- Provide new frame to locate strut towers, control arms, engine, driver seat, etc...
- Allow for alignment of suspension components

Performance Requirements:
- Capable of climbing 20% slope with a 1100 lb load
- Power an automotive alternator (when needed) as an auxiliary power unit (and 12V DC outlets)

What are the most common BUV applications?
- Medical vehicle
- Farm vehicle carrying farm inputs / outputs
- Material carrier at construction projects
- Water distribution (drip irrigation) or water purification
- School bus for children
**Design Information**

**Frame Construction**

1. **Front Frame**: Constructed from 1-inch steel tube, the front can be disconnected from the rear frame for shipping in the bed.

2. **Back Frame**: Made of 1-inch steel tube, the rear frame supports the bed. Leaf springs and the front springs from the donor vehicle are used to support the 3,100 lbs regulated.

3. **Drive Wheels**: Mounted on the front, these aggressive and durable wheels will pull the BUV through any terrain encountered.

4. **Rear Wheels**: Maximizing the use of the donor car, we used the rear axle and wheels for the rear end assembly.

5. **Bumper**: Constructed of 1½-inch tube, the bumper bolts to mounts on the front frame so that it may be removed if damaged and for shipping purposes.

**Power Transfer**

**Transmission**
- Type: Continuously Variable Transmission (CVT)
- Recommended Horsepower: 8 HP
- Min Drive Belt: 7/8” Top Width
- Drive Clutch Engagement Range: 1600RPM Max: 3100RPM
- High 1:1, Low 2:43:1

**Transmission Ratios**
- 1st: 11:1
- 2nd: 6:1
- 3rd: 3.8:1
- 4th: 2.8:1

**Drive Sprocket**: 16 teeth
**Driven Sprocket**: 48 teeth
**Reduction**: 3:1

**Engine**
- 10hp Briggs Intek I/C 10 amp alternator
- Overhead Valve Design
- Cast Iron Cylinder Sleeve
- Mounting: Horizontal
- Electric Start: Recoil & Electric
- Fuel Tank: 1 gallon
- Shaft Size: 1 5/32"-21/32"
- Height: 16.3"
- Depth (Less Shaft): 12.2"
- Width: 16.3"

**Bed Construction**

1. **Bed Floor & Sidewalls**: Made from deck boards, the wood is lightweight and easily replaceable as compared to other materials.

2. **Tailgate**: The tailgate is hinged at the top and bottom. Unpinning the top allows the tailgate to swing down like a conventional pickup truck tailgate. Unpinning the bottom will allow the tailgate to swing out like a dump truck tailgate to allow spreading of rock, mulch or other loose materials.

3. **Bed Frame**: Constructed from 1-inch steel tube and ½ inch angle iron, the vertical posts will un-pin from the bottom frame to allow the wooden side to be removed for repair or hauling large items.

4. **Bed Doors**: Capable of dumping, the bed is hinged in the rear with a locking mechanism in the front.

Updated design with dumping mechanism and tailgate hinged at top or bottom.
Specifications

Cost: $1000 for materials (unassembled)
Payload: 1,000 lbs (including driver)
Max Dimensions: 10 ft length, 62" width
Cargo Bed Length: 6'6" minimum
Ground Clearance: > 8"
Engine: 8.5 hp - 12 hp air cooled, internal combustion engine
Driveline: Two wheel drive, Front Wheel Drive
Angle of Approach/Departure: > 45 degrees approach, > 35 degrees departure
Driver Seat Height: Sitting surface of driver seat < 36" from ground
Tires: Aggressive Tires or Tire Chains
Safety Equipment: Driver seat belt, parking brake, bumper, horn, brake light, front lights, rear lights, kill switch, eight light reflectors (2 per side), tie-downs, or boat chains (for securing cargo), "anti-roll" protection (roll-bar stops vehicle rotation at 1/4 roll), Provide generous safety shielding to protect driver and cargo from moving parts

The Cause

The idea of the Basic Utility Vehicle (BUV) Power Module is to incorporate the driver, the powertrain, suspension, and controls (i.e. areas of complexity) in one small space between two drive wheels. The vision is for the power module to be assembled by medium sized businesses in Africa. The rear unit is extremely simple, adaptable, and can easily be fabricated by small businesses throughout Africa. These businesses will provide needed transportation products while providing jobs for families.

Problem Statement: Starting with the front components from a used Toyota Corolla or Toyota Tercel (both high volume global designs) with a manual transmission, design a vehicle to re-use the components to the specifications above. The vehicle is intended to be a cargo carrier for small businesses. Design emphasis is on the power module with regard to cost, ease of assembly, durability, and kit packaging.

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