FULL DESIGN SPECIFICATION FOR BUS CONVERSION 2016

Goals

- Solid movable space for me to call home
- Base for my adventures, storage for my adventure gear
- Needs to sleep 2 people really comfortably, but up to 8 people ideally
- Drivable on car licence
- Single decker for simple storage and manoeuvrability
- High quality construction
- Unique, interesting and identifiably crafted by me
- Adaptable space. Able to use it for one person, two people, 8 people, as a music studio, expedition planning space, etc. Able to use it to carry equipment inside.
- Comfortable but also highly functional
- Light, airy, well ventilated
- Well insulated and heated
- Ability to live on and off grid
- Rentable. Opportunity to make extra income while on travels.
- Plenty of storage, neat storage solutions
- Roof rack and ladder
- Easy to maintain

Basic Design & Floorplan

The bus will be split into three rooms: a living space, a bathroom, and a bedroom. The bedroom will be at the rear, and the living space in the middle of the bus, with a small bathroom in between.

General Decisions

Wood types to use & direction of panels
Build schedule (first, second fix etc)
Fire retardant
Colour scheme
Paint or varnish
Metal finish (stainless steel, chrome, brass, iron) for fittings (hinges, handles)
Build mounts for roof rack first?
What, if anything, to outsource?

STRUCTURAL

Flooring

Initial ideas: The original floor will be stripped up and replaced with a well-insulated, well protected new floor created from various layers of material. The steel floor will be rust treated and waterproofed and then framed with 2x3 wood, filled with insulation, then a plywood subfloor before being covered with oak or pine floorboards. Service/inspection hatches will be built into the floor to access the engine compartments and storage hatches. The bedroom will be carpeted to help preserve heat. Electrical duct. Hatch for firewood.

To investigate and decide upon: rust treatment paint (direct to metal), waterproofing options, amount of multi-foil vs kingspan insulation needed, how much depth I have, ply subfloor thickness and price, framing material. wood for floorboards. Location of hatches. Best hatch material to use, hinges, pull rings/handles, seals, fire retardants. direction of floorboards and joists (probs lengthways).

Rear & Side Walls

Initial ideas: The exterior walls are currently made from sheet metal, steel framing, and plastic/ fibreglass covering. The covering will be stripped off, the walls rust treated and sealed, and a layer of insulation installed before fire-retardant matchboard is attached to wood framing.

To investigate and decide upon: rust treatment, waterproofing, insulation, space, how much they will stick out, whether I want slots for insulated window shutters, position of timber framing taking into account internal wall positions and cabinetry, ducts/conduits for electrical cabling and pipework, lining (matchboard?), electrical switch positions, fire retardants

The side walls that aren't covered by windows = 10m2 each

Ceiling

Initial ideas: The ceiling will be rust proofed, waterproofed, insulated, and clad with matchboard. There will be removable channels along the side corners with access hatches for electrical and plumbing maintenance.

To investigate and decide upon: rust treatment, waterproofing, insulation, space, depth/height, curvature of ceiling, position of timber framing taking into account internal walls and cabinetry, ducts/conduits for electrical cabling and pipework, design of roof hatches, lighting attachments, cladding material, ply sub-ceiling? hole for flue pipe, attachments for hammocks, attachments for roof rack. direction of matchboard, smoke alarm.

Interior Stud Walls

Initial ideas: There will be two interior walls. One will separate the living area from the bedroom, and then one will surround the washroom. The one between the bedroom and living space will be 40cm thick and will contain bookshelves facing into the living space.

To investigate and decide upon: Whether to insulate, how to get heat from living space to bedroom (see heating), thickness of walls, location of walls, door and window cutouts, storage in walls, cladding, framing position, reinforcements, hinged walls for front,

Windows & Doors

Initial ideas: There will be five doors in total, three internal and two external. The main bus door at the front will be the main entrance. There will then be a separate hinged door opening inwards into the living area/kitchen. At the rear there will be a sliding door into the bedroom, and an outward opening hinged door into the washroom. There is a second access to the bedroom through the emergency door at the back.

To investigate and decide upon: How to hinge the doors, whether to insulate inside the doors, size of doors, handles, hinges, thickness of doors, lockable or not. What to do with all the windows. Which ones to keep. Which ones to board up, how to board them up. Kitchen window, semi covered. Make them openable. Magnetic curtains.

Insulation

Initial ideas: The exterior walls and partitions will be insulated with foil lined Kingspan. The roof and floor will be insulated with Multifoil insulation. Other places will be insulated with foil lining. Pipes will be insulated with foam lagging.

To investigate and decide upon: supplier of insulation, area needed, go and see Encon and Cotswold Aircraft Salvage. Vapour barrier. Thickness of insulation?

Ventilation

Initial ideas: Extractor fan above kitchen, passive stack ventilation panels floor height and ceiling height, openable hatches x 2, bathroom vents, battery vents, fridge ventilation, mushroom vents. gas ventilation.

To investigate and decide upon: Location and types of vents, manual or automatic, power needs.

Soundproofing

Initial ideas: around engine bay, silencer on exhaust, and 2mm thick acoustic insulation on ceiling, walls, and floor. Mass loaded vinyl barrier (MLV) or soundproofing paint for direct to metal surfaces.

To investigate and decide upon: speak to Peter Fish.

Cabinetry & Room Layouts

Initial ideas:

<u>Kitchen</u>

50cm x 180cm x 72cm cabinets with slide out extra worktop. Thick kitchen worktop that is hinged to reveal hobs (like Cheltenham Nyala). Built in cooker, microwave, fridge and sink. Drawers and cabinets. Overhead lockers with extractor fan built in. Draining board storage. Pull-out pantry (ie. Sausalito house). Secret liquor cabinet. Worktop to be oak or iroko (recommended as naturally oily, resistant to water).

Living Room

All free-standing furniture lockable into place. 6 x couch parts that slot into place and can be rearranged or stacked depending on needs of the day. Grooves on top and bottom that make them stackable and also provide ridges for cross-piece to sit on (like Nyala). Open up to form double bed. Storage hatches underneath accessible from underneath cushions or drawers pulling out. Angle-iron reinforced. Piano converted into storage for kitchen supplies and other bits and bobs using wooden apple boxes.

Bedroom

King-size double bed fixed in place at rear of bus. High bed with plenty of storage underneath with clothes drawers that open forward, and a large trunk accessible from above via a hatch. Possibly accessible as large sliding drawer through luggage storage area.

Washroom

Platform built over wheel arch to put composting loo on top of. Full-height wood panelled shower/ wetroom.

To investigate and decide upon:

EVERYTHING!

SERVICES

Heating

Air Heating

Initial ideas: 4kw multi fuel burner in main living area with flue through the roof. Thought about Eberspacher/Webasto diesel heaters but Alan Minchin recommended against. Maybe as a backup or for water heating.

To investigate and decide upon: Power of wood burner needed, cost of flue etc. Do I want a back boiler or integrated oven, or stove top? How do I get heat from wood stove through to bedroom and bathroom (leave bedroom door open!)? Where best to place wood burner? How to insulate flue pipe? Size of flue? How to insulate space around stove? Any legal requirements similar to building code?

Water Heating

Initial ideas: Options for water heating include back boiler on stove, Eberspacher/Webasto electric water heater, Atwood/Suburban gas-powered water heater. As I will probably get a second hand wood stove, it's unlikely to have a back boiler on it. I may be able to fit one but I think it would be easier to have a separate gas-powered tankless water heater. Gas seems to be the recommended option for water heating. I can have one fuel bottle for hot water and one for the gas stove.

To investigate and decide upon: Mount the water heater inside or outside, propane or electric or dual? What controllers to use?

Plumbing

Initial ideas:

Potable Water Supply & Storage

Underfloor tank with lockable filler cap mounted in side of bus, plus shore hookup.
Automatic system so that water goes straight to taps/water heater when mains water connected but turns the pump on when no mains water connected to use the tank water (one way valve to prevent back flowing towards tank).
Self-priming diaphragm pump (Shurflo) with inline pressure switch that only turns on when opening taps drops water pressure below 1 bar psi.
Ability to fill tank from mains water by opening second valve which bypasses one way valve and allow back flowing into tank. ??
Drainage hose at bottom of tank for winterising.
Pump isolator switch on main control panel.
Water level gauge on control panel.

Greywater Storage

Underfloor tank with inputs from shower, kitchen sink and washing machine. Drainage valve and pump with hosepipe. Bypass to septic tank? Overflow alarm? Vents.

Pipework

Push-fit plastic pipework internal.

To investigate and decide upon:

- What size, shape and grade of water tanks should I use for potable and grey water?
- What pump should I get (PSI/flow rate) and where should I put it? Do I only need one?
- If I were to have a flushing loo instead of a composting loo, how much would it cost (blackwater tank, fitting etc)?
- How will I ventilate the greywater storage? Shower trap?
- What size and type of pipe should I use? How should I insulate?
- Mixer taps or separate taps?
- How to monitor tank levels etc?
- What else haven't I thought of?

Electrical Setup

Initial ideas:

Appliances/Power Requirements

Appliance	**Watts**		
Lighting			
Fridge	Propane most of the time.		
Water Pump			
Washing Machine			
Microwave			
Piano			
Tools			
Cameras			
Macbook Pro Retina	60		
Control Panel			
TV Projector			
Phone			
Iron			
Vacuum Cleaner			
Printer			
Stereo System			
Router/4G Dongle			
PA Speaker			
Freezer			

Batteries

2 x 12V 120AH deep cycles batteries in parallel = 240AH of 12V electricity.

Generators/Chargers

5 charging options: mains power via an inverter/battery charger, petrol generator, alternator, solar/ wind (trickle charger), thermo-electric module from

Cabling & Drawwires

Most cabling will run in conduits down the length of the bus. Need to decide where these will go. Probably in ceiling but possibly underfloor at edge.

Lighting

LED lighting throughout. Spots in ceiling. Functional lighting in kitchen (above counter), bedroom reading light, make as much use of natural light as possible.

Distribution Boxes

Inverters/Converters

Switches

Meters/Gauges

Socket Positions

Shore Power

12V Supply

Ducts/Conduits

Gas Setup

Initial ideas:

Haven't thought too much about yet. Refillable tank (like LPG cars) or plug and play Calor bottles? To supply gas oven/hobs and water heater.

Electronics

Internet
CCTV for reversing

APPENDIX

Suppliers

Timber: Oxford Wood Recycling, Deep in Wood, and scrap
Insulation: Seconds and Co, Encon, & Cotswold Aircraft Salvage

Useful Info

http://deepredmotorhome.com
https://www.youtube.com/watch?v=a_gNcz1Pz8c
http://deepredmotorhome.com/water.php
The Golden Ratio a+b : a = a : b
http://www.antares.co.uk/design-tools.html