TVR Chimaera Body Off Guide

Version 1.0

22 November 2009

Feel free to copy and distribute this guide to anyone who is interested. If you find errors or have suggestions then drop me an email at APReardon@aol.com and I will consider for inclusion in the next version.

Section A: Introduction

For no reason other than 'having a feeling' that it was worth checking the parts of my car's chassis that are normally hidden from view, I decided to undertake a full body off inspection of my 1998 Chimaera 450 in November 2008. Whilst there are useful hints and tips in various places around the Internet there's a lack of a single repository of information, a guide even, for the task. Hence the creation of this document.

I have tried to make this guide as useful and complete as possible without being too pendantic (I'll assume that you don't need me to tell you how to unscrew a jubilee clip for instance. If that's a poor assumption then you're not up to the job). However, there will always be little actions or tips that I neglected to document as they seemed too obvious or went well during my project but can be a real pig on other cars. If you feel there are omissions or mistakes please email me APReardon@aol.com and I will evaluate and consider adding to this guide.

Good luck, Alex Reardon

Disclaimer: This guide is meant as a means of sharing experience and is not intended to be used as a definitive set of instructions. It is your responsibility to assess the guidance within this document and decide what actions are appropriate to your particular circumstances. I take no responsibility for any consequences arising from your actions or from any errors or omissions within this document.

Section B: Health and Safety

This section may seem a little patronizing and motherhood but I make no apology for that. Make sure that you read it: any damage or injury caused through your work is your fault, no-one else's.

If you are considering undertaking any significant work on a motor vehicle you must obviously assess your competence to perform the tasks safely and to a standard appropriate to use of the vehicle on public roads. If you are the kind of person who struggles to figure out which end of a screwdriver to use to undo a bolt then do not attempt to work on you car. At best you'll end up with a bodged result. At worst, and perhaps more likely, you'll end up damaging yourself or other people.

In this project you'll be dealing with:

Petrol: This is an ongoing problem, not just when you drain the fuel tank but when you remove fuel lines, fuel pumps or filters, even when you move the tank. Make sure that you're working in a well ventilated area with no risks of sparks or sources of ignition. Be prepared to suddenly, and frustratingly, find that there's still petrol left in the fuel system. You'll also have to do something with the fuel that you drain out of the tank. I captured my precious go go juice in a clean oil drain pan then, using a filter with a built in particle strainer, decanted it straight into my brother's waiting car. And the little so and so didn't offer to pay me for it. You should also plug any fuel pipes with an appropriately sized bolt, wrapped in PTFE tape and secured with a jubilee clip.

Trip hazards: inspection lamps, trolley jacks, tools. There's a whole variety of potential hazards just waiting to catch you out. Chances are that you don't have a large 400 sq ft, fully lit and kitted out workshop and that you're undertaking this work at home in conditions that will always be a little smaller and more cramped than you would like. Keep things tidy. Clean and put tools away when you've finished with them. Think about the routing of any electrical cables for lights, inspection lamps, power tools, heater fans etc.

Anti-freeze: You will spill anti-freeze when you drain the cooling system, move the radiator, etc. Although a favored ingredient in certain cheap wines of dubious origin it can be fatal to animals if they lick it up. This does happen. A few years ago as the weather turned cold, one of my daughter's beloved moggies died through some kind of kidney failure caused, we believe, by him wandering off under a neighbour's car and lapping up some spilled anti-freeze. It's not nice, so if you spill any, clean it up straight away. Remember, it's not very likely that you will be able to remove coolant pipes in a nice orderly and controlled fashion. Coolant will go everywhere, especially over chassis rails, horizontal parts of the engine compartment where it will pool, ready to drip down at some later date. So when you drain and spill, clean up everywhere.

Storage: you are going to be removing a lot of parts from the car. Make sure that you have somewhere safe to store them that ensures they are protected from damage, that they in turn will not cause damage (possibly not the best idea in the world to keep the exhaust pipe in the middle of the lounge carpet) and that they will not cause any kind of trip hazard.

Lifting: at some point you and a bunch of friends will be lifting and moving a heavy body around. It might be fibreglass but it still weighs a fair bit and will hurt if it falls on someone. Make sure that everyone involved is fully aware of the risks, knows how to lift properly and that if it all starts going wrong to shout “stop!” and get out of the way.

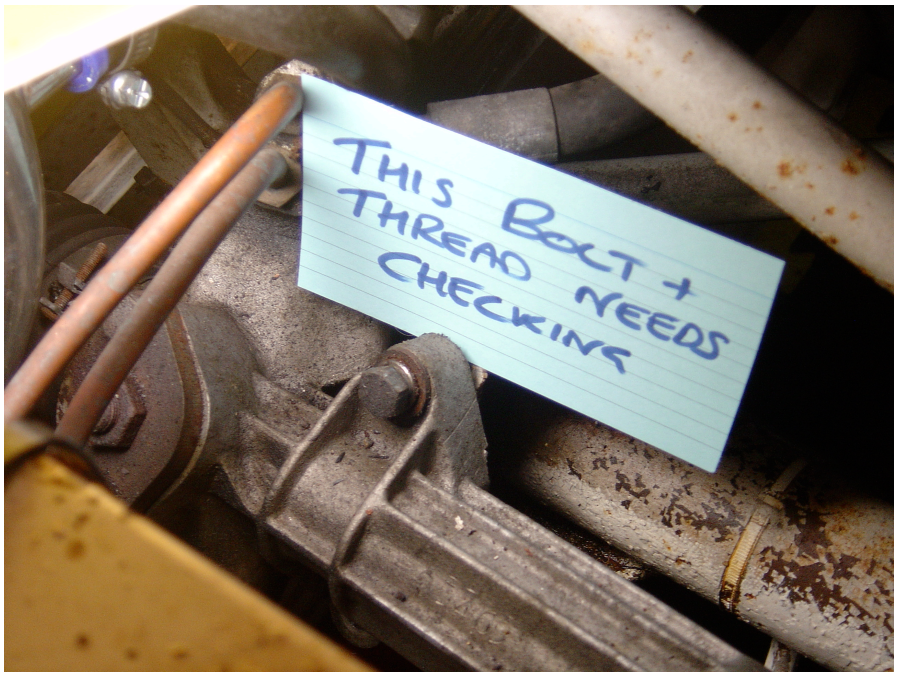
Safe working with tools, axle stands etc.: Hopefully it goes without saying, but the safe way to to the job is with the right tools. You don’t need much in the way of exotic equipment to take the car apart but do make sure that the tool you’re using is appropriate to the task both in terms of fit and strength.

This is not an exhaustive list. The bottom line is that you are the health and safety manager on this project. It’s down to you to evaluate the risks and difficulty of tasks. And it’s down to you to do the job right and ensure that your car is fit and safe for use on the road. If at any stage you’re in doubt, stop and re-evaluate. If you’re not up to it then don’t do it and get some skilled help. There’s no embarrassment in being shown the right way to do something; there’s a lot of embarrassment and regret in finding out too late that you were careless.

Section C: Meet your new best friends

There are a few additions to your tool box that are going to be invaluable in helping you to do this job.

Notebook: this is obvious but make sure that you log everything. Add copious comments, draw diagrams, index parts, note down extra jobs that you need to do/parts that you need to get.



Cards: I used small index cards to make labels for bags of parts or for providing a visual label in photographs. For instance, I was concerned about the thread on a steering rack bolt that seemed to come off a little too easily so scribbled up a card with a message that I photographed.

Digital camera: get yourself a camera and photograph absolutely everything. Consider making small labels/instructions/comments on paper that you include in the photos. If you've got the ability to take video do so and provide yourself with an audio commentary as well.

Coloured cable ties: cable ties aren't just useful for holding things together. Small coloured cable ties can be fantastic in helping you label pipes. For instance, when I removed the brake and clutch pipes from where they enter the bulkhead I used different colour table ties for each pipe and then recorded that in my notebook to make sure that I reconnected them correctly later.

Balloons: useful for closing off piping and inlets to protect from dirt and small parts. Hold them in place with cable ties. If you're using them on brake/clutch pipes then remember that brake fluid will cause the rubber to perish, so use several layers.

Freezer bags**:** taken off some bolts? Stick them in a freezer bag and put in a small piece of card with either a description or a reference code that you then log in your notebook (e.g. card in the bag says "S2' which is then referenced in the notebook as "Passenger Seat Belt Bolts").

Section D: Thinking about getting on with the job - and making sure that you do.

If you're going all the way for a full body lift then it's going to take some time. Whilst I didn't keep a log of the time spent, I suspect that (excluding any repair work) the basic tasks of disconnecting everything, lifting off the body, putting the body back on and reconnecting everything probably took about 40 hours. And that's the easy bit. If you find that you need to replace wishbones/bushes, if you want to take out the diff or gearbox you'll need to add oodles of hours depending on how corroded, stuck or stubborn parts are. So, if you're doing this in your spare time then it's going to take a few months. And that means that at times you're going to get a bit fed up and despondent. So to counter act this set yourself some targets. Here were mine:

9th Nov 08: Last Goodwood Breakfast Club of the year: start the project as soon as we get back from Goodwood and be back at the circuit for the first Breakfast Club of 2009 on 1st March.

Project start plus one month (7th Dec): lift off the body. I committed this date before I started the project. By committed I mean that I told my mates who were going to help lift the body off that was the day that they'd be around to help. That rather meant that I either got on and had everything ready OR suffered the severe embarrassment of having to say *"actually chaps, turns out that I'm a real lazy bugger, I haven't got around to doing what I said I was going to do and we'll need to go for another day."*

Project end minus one month (1st Feb): another public commitment that I made from the outset was to fix the date that the team would be around again to lift the body back on. Rather focussed the mind that one, especially when I was getting slightly demotivated when I just seemed to be taking more and more bits off rather than putting it back together.

1st March: again, I made it clear to friends and family from the outset that I'd be driving the car to the first Goodwood Breakfast Club of the year. Having that kind of event based target really helped drive me once the body was back on. And boy did it feel great as I pulled into the circuit.

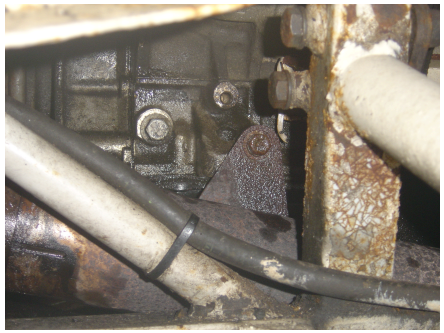
Section E: On with the job

Here's the sequence of tasks that I went through to take the body off. Now I'm documenting them (based on my notebook and photos) some of the tasks are in an odd order (why didn't I do all the cooling system together for instance) but it was the order that I looked at things and perhaps it provided a bit of variety.

TVR use copious quantities of cable ties to hold pipes and wiring in place. I have not referenced the removal of these cable ties. You decide which ones need to come off and then make sure that you replace them later!

1	Open boot and put a towel over the lock/latch. Lower the windows.	Once you disconnect the battery opening boot and windows is no longer an option for you!
2	Disconnect and remove battery.	
3	Remove bonnet.	Get two helpers to take the weight of the bonnet as you remove the allen headed bolts.

4	Remove boot lid taking special care to note whether any spacer washers are used to under the hinge brackets to ensure correct realignment when refitting.	
5	Disconnect cable to and remove airflow meter.	
6	Remove spark plug leads and distributor cap.	
7	Jack car up to working height and support on stands.	
8	Remove tray under exhaust silencer box.	
9	Remove rear anti roll bar - note the way that the curved washer fits.	
10	Remove cables to lambda sensors on exhaust catalytic convertors.	

11	Remove exhaust - note that there is a small bracket and bolt that holds the exhaust to the near side of the engine block as shown in the image.	
12	Remove exhaust Y pipe (that goes between the main exhaust pipe under the car and the manifolds.)	

13	Remove near side manifold - this is just a tedious job where you have to be resigned to making a small turn of the spanner. flipping the spanner over, making another small turn, flipping the spanner over again and so on.	
14	Remove off side manifold.	
15	Drain radiator.	
16	Drain header tank.	
17	Drain swirl pot.	
18	Disconnect starter motor solenoid wire - take the opportunity to check that connector is secure; on mine the cable pulled out of the connector.	
19	Remove coolant hose between swirl pot and radiator.	

20	Remove header tank.	
21	Disconnect radiator fan connectors (x2).	
22	Unscrew radiator bolts.	
23	Disconnect the cable between the 100amp fuse and the starter motor.	
24	Disconnect cable between the 100amp fuse and the battery.	
25	Remove plenum chamber cover.	
26	Remove throttle cable. Note: you may find this easier to do if you first remove the bonnet catch.	
27	Remove fuel and vacuum pipes to plenum chamber.	

28	Disconnect pipe and pump wire from washer bottle.	
29	Remove washer bottle.	
30	Remove coolant hose between swan neck and radiator.	
31	Remove pipe from header tank.	
32	Remove radiator.	
33	Remove bolts from front of chassis A and B (see Section I “Chassis Bolts”) in radiator area. Note that offside A bolt holds earthing wires. Take the opportunity to make sure that the connectors are clean.	

34	Drain fuel tank by disconnecting the hose at the bottom near side of the tank. There will always be more fuel in the tank than you expect so make sure that you've planned ahead both in terms of how you will capture the fuel that comes out and what you're going to do with the fuel. Putting it into another car's not a bad idea but make sure that you transfer it through a filter that has a strainer gauze in it to avoid passing on some of the crud and debris that lives at the bottom of your fuel tank.	
35	Place a bolt wrapped with PTFE tape into the pipe from the fuel tank and tighten with a jubilee clip. There will still be fuel in the bottom of the tank and you don't want this flowing out when you remove the tank and carry it out.	

36	Mark the position of the upper and lower universal joints and the rod on the steering assembly to allow you to refit them in the same position as you removed them. Tipex is good for this.	
37	Loosen both upper and lower universal joints.	
38	Remove steering rack bolts.	
39	Remove universal joint bolts to remove steering rod then replace bolts back in the UJs so you don't lose them.	Note: If you may need to move the car around before lifting the body off you might want to skip these steps.
40	Remove distributor advance pipe to plenum chamber.	
41	Remove plug to throttle position sensor.	
42	Remove oil breather pipe.	

43	Remove connector to otter switch on bottom of swirl tank.	
44	Remove plug to stepper motor.	
45	Label and disconnect wiring to coil.	
46	Remove coil.	
47	Remove ignition module.	
48	Remove pipe from plenum chamber to air sensor.	
49	Remove plenum chamber.	Note: Place scrunched up freezer bags in inlet trumpets to prevent dirt and small bits falling into the cylinders. Cover trumpets with balloons and secure with cable ties until you are ready to remove the inlet manifolds.
50	Remove swan neck.	
51	Remove coolant hose between swirl tank and engine block.	

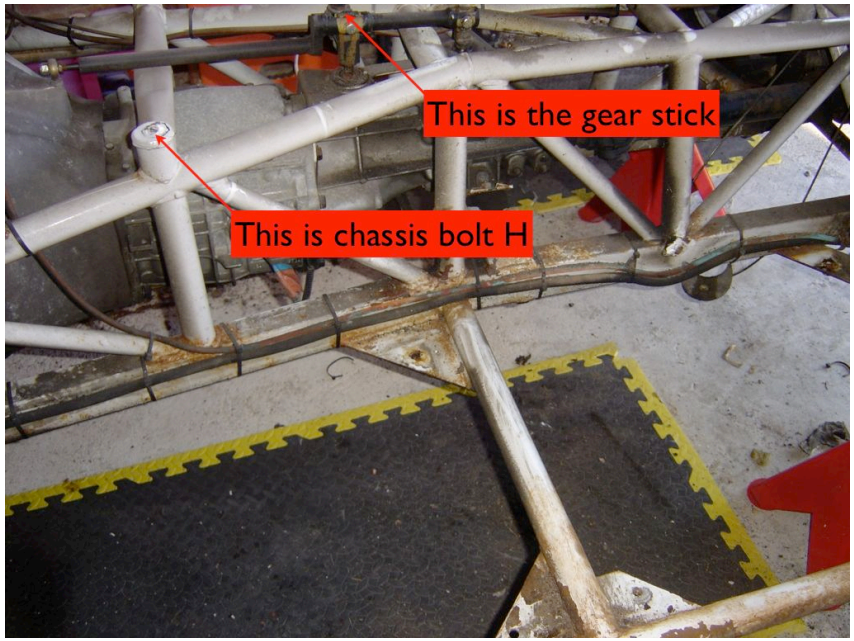
52	Remove coolant hose between heater pipe and engine block.	
53	Remove pipes that run alongside the rocker cover to heater pipes.	
54	Disconnect fuel pipe to injectors. Use coloured cable ties to show which pipe goes where.	
55	Remove driver’s seat bolts.	
56	Remove chassis bolt W for driver’s seat belt guide.	
57	Remove driver’s seat belt reel.	
58	Remove driver’s seat.	
59	Remove passenger seat bolts.	

60	Remove chassis bolt X for passenger seat belt guide.	
61	Remove passenger seat belt reel.	
62	Remove passenger seat.	
63	Remove upper fuel tank bracket bolts including removal of the brackets for spare wheel straps.	

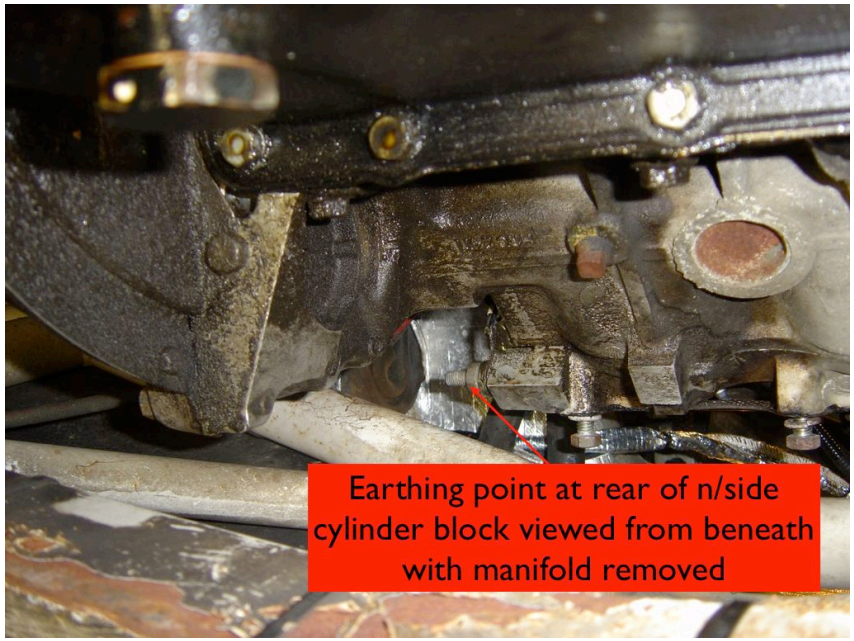
64	Remove fuel tank strap bottom bracket bolts beneath the car. Near side bolt shown in this photo.	
65	Disconnect return hose to top of fuel tank filler.	
66	Disconnect fuel line o/s by rear suspension.	
67	Move fuel tank to gain better access to chassis bolts in boot.	
68	Remove gearstick knob, backing bolt and gaiter.	

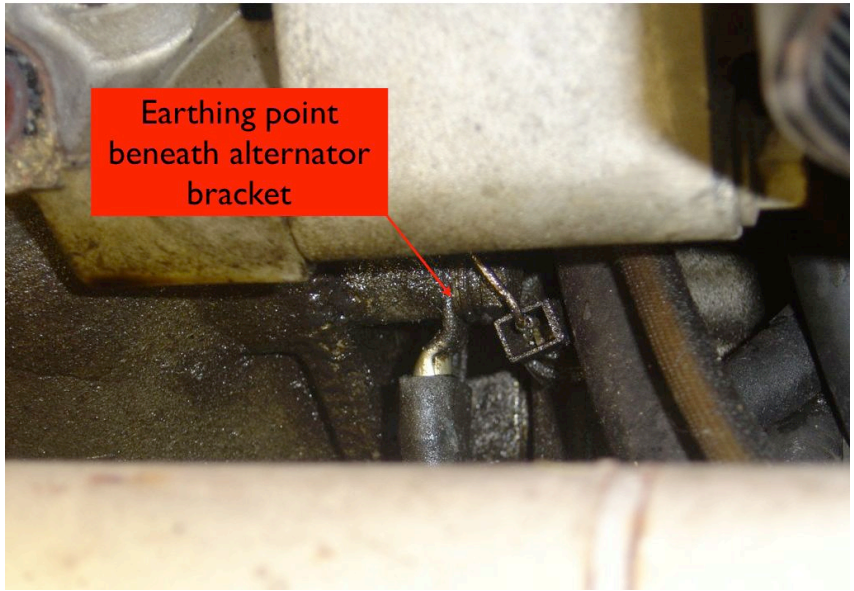
69	Remove centre console.	
70	Label brake/clutch pipes where they connect to bulkhead with coloured cable ties	
71	Working from underneath the car remove split pin from handbrake above gear box. Note: take photos and draw diagrams of this to aid refit.	
72	Remove 10mm bolt to handbrake.	
73	Remove 13mm bolt to handbrake. Note: when refitting these handbrake parts coat in thick waterproof grease.	

74	Remove handbrake handle.	
75	Remove chassis bolts: S T U V	Note: see Section I “Chassis Bolts” for description and locations of the bolts.
76	Remove chassis bolts: M N O R	
77	Remove chassis bolts: P Q	
78	Disconnect wiring plug in centre console for electric windows.	
79	Remove 3x philips screws that hold the door release knob in place.	
80	Remove chassis bolts: I J K L	
81	Remove chassis bolts: Y Z	

82	Remove chassis bolts: G H. This is probably the most difficult task in the whole project. These bolts are accessible, with some effort required, through the fibreglass channels either side of the gear stick. The bolts are some way forward of the gear stick. Bear in mind that bolt H is an earthing point; you will need to remember this when you reassemble the vehicle. I found that a combination of a long spanner through the channel and small socket set coming in under the carpet at right angles allowed me to get the access required. You may need to peel back the carpet to get a decent access. To help work out where these bolts are look at the following picture of the chassis.	
83	Remove battery box.	
84	Remove chassis bolts: C D E F	

85	Working from underneath disconnect speedo wiring from gearbox.	
86	Disconnect reversing light wiring from gearbox.	
87	Drain fluid from brake system at each caliper.	
88	Drain fluid from clutch slave cylinder.	
89	Disconnect engine/fuel management system wiring.	
90	Label and disconnect wiring to alternator.	
91	Remove fan belt.	
92	Remove alternator.	

93	Disconnect wiring to oil pressure and temperature sensors.	Note: you may also have a small connector that runs between the sensors and wiring in the radiator/carbon canister area. If so, disconnect.
94	Remove bolt in o/s wheel arch that holds carbon canister in place.	Note: the carbon canister is housed in the o/side wing and is visible with the radiator removed.
95	Disconnect pipe to carbon canister in o/s front wing and feedback into engine bay	
96	Disconnect earthing wires on rear n/side engine block near cylinder head.	

97	Disconnect earthing wires on engine block beneath alternator.	
98	Go round the engine bay and underneath the car to ensure that all wiring is disconnected.	
99	Remove front anti roll bar bolts and drop links.	
100	Remove front anti roll bar.	

101	Disconnect fuel level sensor wiring from fuel tank.	
102	Disconnect return pipe from carbon canister connecting to the o/s rear of fuel tank.	
103	Remove fuel tank from boot.	
104	Remove dome headed chassis bolts AA AB behind fuel tank, These bolts are 1/2 way down the rear bulk head. Note that near side AB bolt is an earthing point.	
105	Remove swirl tank.	
106	Disconnect power steering reservoir from its bracket.	Note: I didn’t do this and at one point during the lift, as we were resting the body, the bracket bent.

107	Remove inlet manifolds and remains of plenum chamber. Take care that nothing falls into the inlet ports. Cover the inlet ports with duck tape to protect from debris.	
108	With luck at this point everything between the body and the chassis is disconnected. Try to lift the body an inch or so at the front and then the rear to satisfy yourself that all chassis bolts have been removed. It is best to do this with the road wheels refitted and the car back on the ground to avoid risk of falling off of the axle stands.	
109	Check in the engine bay to ensure that anything that adds height to how far you need to lift the body has been removed.	

110	Raise the car off the ground back on to its axle stands again and crawl all around it to check that there are no pipes, wires or other potential snagging points left. Then check once more. If you're happy then it's time to get ready for the big lift.	
111	Lower car back on to the ground. Do not attempt the body lift if the car is up on axle stands: firstly it's dangerous and secondly there's no point as the car will be too high to lift safely!	

Section F: The body lift.

The first, second and third thing to remember about lifting the body is "safety first". Make sure that you properly brief your lifting team. Ensure that there are no trip hazards, that the ground is not slippery and that if it starts to fall to get right away from it. The body is heavy and a trapped foot or leg will suffer badly.

Remember that the handbrake no longer functions so you will need to use wheel chocks to stop the car rolling in either direction as you remove the body off.

We used seven people for the lift:

One on each wheel arch

One on each side at the front of the car

One to watch from the front end of the car and shout out if any thing snags or starts to go awry.

Section G: Refitting is the reverse of disassembly!

In theory, putting the car back together is very much the reverse of taking it apart. If you've labeled parts, stored them properly and kept a good set of photos parts will fly back on faster than you took them off.

Whilst the body is off and there's great accessibility it's worth taking the opportunity to do those jobs that would be a real pain later. Certainly it's well worth replacing the fuel lines within the engine compartment. If these perish the consequences can be both dramatic and traumatic so whilst everything is accessible make the small investment in new fuel hoses. Caution: ensure that you are using suitable replacements rated for petrol and the pressure expected in the fuel system.

As you come to replacing the body onto the chassis it's important to ensure that there are no cables or pipes trapped. One of your body lifting team will need to keep looking all the way around the car trying to spot problems. But - remember that safety comes first and at no point risk life or limb trying to reach in under a heavy body that could slip at any time. In particular look out for the cables and connectors that hang down in the transmission tunnel and the brake and fuel pipes.

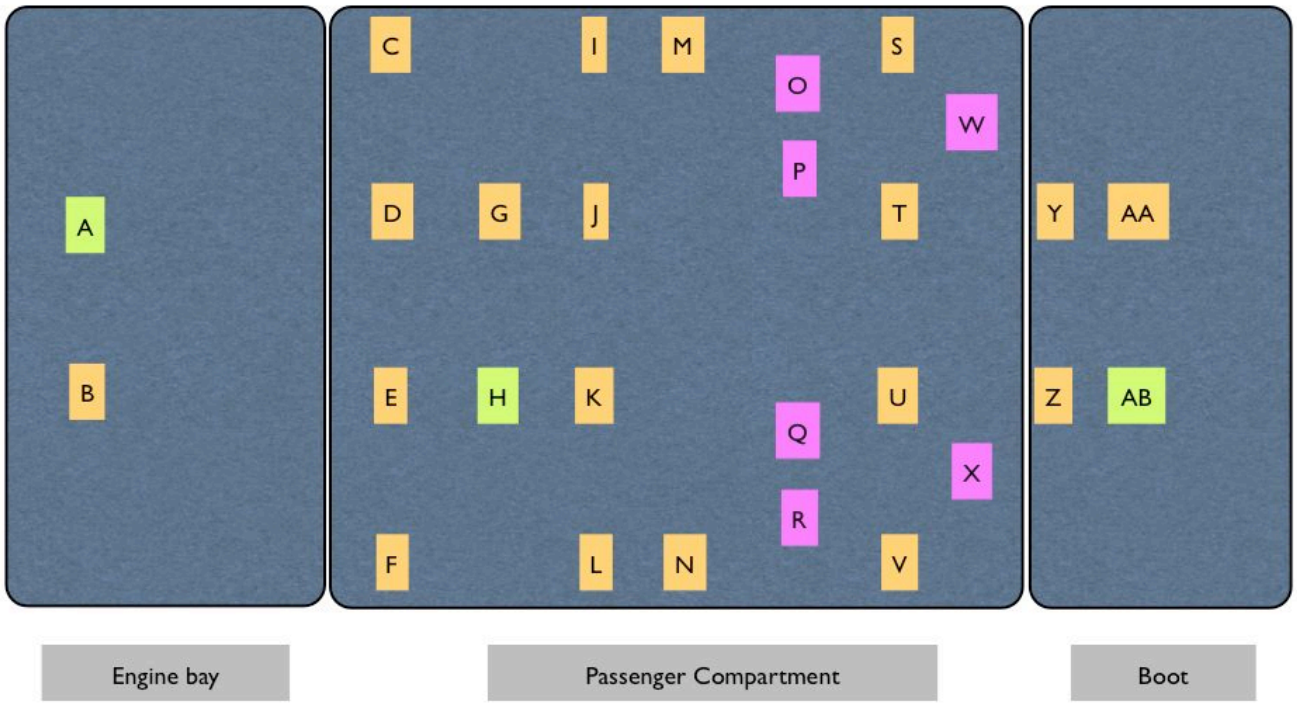
Section H: Shake down test

With everything back together it's tempting to start up and go for a spin, but you need to recognise that you've just performed major surgery on the car and that you have check and recheck all key systems, especially those related to safety. It's down to you to make sure the checks are comprehensive and will of course also depend on the particular work that you carried out with the body off, but here are some suggestions:

- Check tightness of all coolant hoses.
- Check tightness of all fuel lines. Trace the lines several times to make sure that everything seats fully and that jubilee clips are appropriately tight.
- Check that all bolts on the universal joints and ball joints in the steering system are properly torqued up.
- Ensure all seat belt bolts correctly torqued up and that the mechanism functions properly.
- Make sure that you have fitted all chassis bolts and the earthing points.
- Double check all unions on the brake pipes and make sure that the system is fully bled with no risk of any air being left where joints were undone.

When you are finally at the point where you're ready to check the car out I'd suggest driving around very close to home so that if you have a problem then you can either get back quickly under your own steam (no pun intended although I did have a small weep on one of the heater hoses that caused coolant to spray out and the engine to overheat!). Test the brakes throughly.

Section I: Chassis bolts - location and description



Earthing points: A H AB

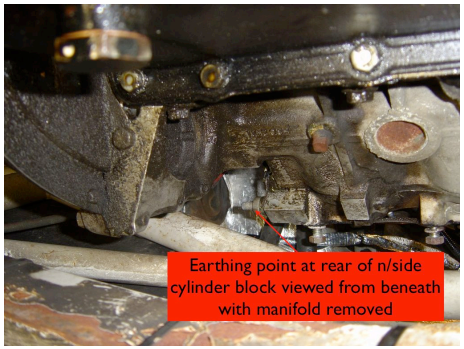
Seat belt attachments: O P Q R W X

Reference	Location
A	Engine bay beneath radiator
B	Engine bay beneath radiator
C	Front of driver’s footwell next to wing
D	Front of driver’s footwell next to transmission tunnel
E	Front of passenger’s footwell next to transmission tunnel
F	Front of passenger’s footwell next to wing
G	On top of transmission tunnel, hidden under a moulded fibreglass channel
H	On top of transmission tunnel, hidden under a moulded fibreglass channel
I	Rear of driver’s footwell next to door
J	Rear of driver’s footwell next to transmission tunnel

Reference	Location
K	Rear of passenger’s footwell next to transmission tunnel
L	Rear of passenger’s footwell next to door
M	Beneath driver’s seat next to door
N	Beneath passenger’s seat next to door
O	Driver’s seat belt to chassis
P	Seatbelt buckle driver’s side
Q	Seatbelt buckle passenger’s side
R	Passenger’s seat belt to chassis
S	Rear of driver’s seat area next to door
T	Rear of driver’s seat area next to transmission tunnel
U	Rear of passenger’s seat area next to transmission tunnel

Reference	Location
V	Rear of passenger’s seat area next to door
W	Seatbelt runner behind top of driver’s seat
X	Seatbelt runner behind top of passenger’s seat
Y	Bottom of boot compartment under fuel tank
Z	Bottom of boot compartment under fuel tank
AA	Dome headed bolt behind fuel tank
AB	Dome headed bolt behind fuel tank

Section J: Earthing points

Chassis	Front end of chassis off side beneath radiator	See Section I, bolt A
Chassis	Top of chassis ahead of gear lever	See Section I, bolt H
Chassis	Rear end of chassis behind fuel tank	See Section I, bolt AB
Engine block	At rear of near side engine block	
Engine block	Beneath alternator mounting bracket