

# The CAMM Shell - Concept for a Custom Case for Your CarPC

Home Telematics ( or CarPCs ) Are Growing But You Just Can't  
Chuck Your Tower In To The Boot – And What If You Change  
Cars..... ?



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## An Overview

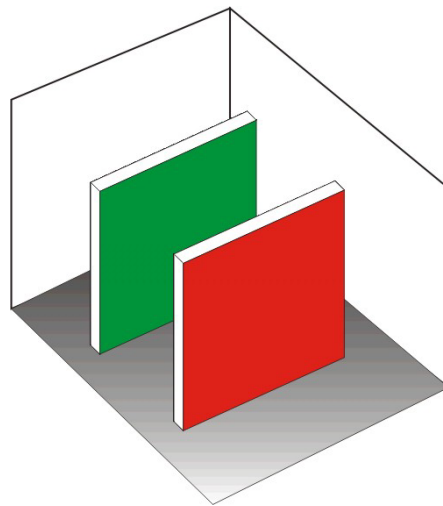
So you have decided to build your self a CarPC then... well done you have made the first step. You know what software your system will have on it and what hardware you want to use, you have even chosen you're new in dash VGA screen but..... where do you mount the hart of the system ? Under the seats ? In the Glove box ? In the boot. The perfect place the boot – out of sight and plenty of air to help cool you system down. But throwing in your desktop with a bit of Velcro may be a solution but it just does not look like it should be there in its horrible 1980s beige colours.

This article is about a unique idea for creating a custom looking boot install for most cars and other private transport which is both easy to do, and transferable. In the article I will explain the basics behind the concept and then explain some possibilities in construction.

## The CAMM Shell Concept

There are three parts to the basic concept. 'The Cage', 'Module' or 'Modules' and 'Arrays' ( hence the name CAMM ).

The core of this flexible system is the module and array concept. That is that you can have one or more modules in the case, each module is basically a grouping of arrays mounted vertically in an easily extractable unit. Let me give you an example of what I see a typical main module looking like.



An Example Module Mock-up

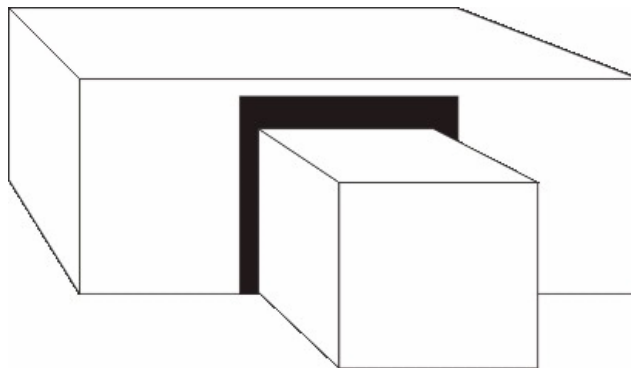
The single module would contain two arrays at least. The first main array would have the motherboard mounted on it. The second array would have the rest of the major components mounted and would sit again, vertically, but just behind the first array. Now, you could mount it with the components of each board facing each other to save space should you be able to space them correctly as the concept allows for this how ever if you have the room my vision would that they will be facing away from each other. This would give two advantages – the first been that the components are protected from each other and the second that there is plenty of space for air to cool the items down... that be said air flow is some thing to consider as well - how ever I will discuss this further on. This configuration will give you the maximum



use of the least space available allowing you to still put a complete system in but not over compromise the boot space which in smaller cars could be crucial.

So that is the internals now let's discuss the module its self. Quite simply the module is a case or a supporting structure for the arrays. A typical construction would look like and empty cube or box as shown here. It could be prepared for use in one of two ways.

The first been a simple case which would simply be mounted inside the cage. The second being a box that slots in to either a draw or a pre-prepared hole with in the cage. This will all become clearer further on.



An Example Cage Mock-up

The module structure would serve a couple of functions. The first to hold the arrays together and securely. The second to allow a common shape or construction for integration with 'The Cage'. Using this common construction method really does cut down on the amount of work later on to customise your system, it also allows for easy construction of other modules to be added when the first has no further space for other arrays. Because the modules them selves are in their nature removable it would not take too much time to construct your connections to the car in such a away it easily removed either for maintenance or security.

Lastly 'The Cage'. I got the inspiration for this from several sources not least of which a simple car stereo DIN slot. The DIN slot is a standard size whole for ICE equipment but where the hole location varies from car to car due to design. 'The Cage' does exactly this, it allows a standard construction ( the module ) be installed very easily in to a non standard shape ( the area where the cage is located ) creating a custom look.

### Planning

OK so you've got the concept... you still need to do a little planning though just for your own situation. Some considerations to think about are:-

- Requirements
- Overall Look
- Individual Boot Construction
- Accessibility
- Airflow
- How it will be secured
- And the materials to be used



#### Requirements:

You may have a lot of equipment such as your Carpc and amplifiers or you may just simply have a Mini ITX mother board and hard drive to mount. Try and plan it in such a way that your module is an appropriate size – may be even with a little extra. A typical mATX board is around 9.6" x 9.6" so really any thing smaller would fit. If you are constructing it so that the mother board is visible remember to plan for an extra layer which is high enough to allow for the fan on the CPU and any PCI / AGP cards needed, you may even need some thing to hel assist the cards them selves stay in position.

If you do not have enough space then consider adding an extra module in to the overall design or even plan for one if you don't need to... you may find a use in the future.

#### Overall Look:

Consider how you want it to look. Do you want it on full show or do you want it to appear hidden ? This decision can influence what materials you will use in the final construction of the whole case as well as deciding the aesthetics.

#### Individual Boot Construction & Accessibility:

Everybody's boot is different – there's nothing we can do about that so let's assume that our basic car has a) an access area for tail lights, b) access area for spare tyre and c) a lump about 2/3rds of the way down the side where the suspension strut is attached to the chaise. Because of this you may need to plan the cage frame to be built in sections in order to go round the obstruction and provide support for your module/s. Also you may need to consider accessibility to the tail lights and spare wheel area. There may even be some legal requirements in your country that mean the full access must be available. This is easily done by simply adding some kind of door or flap just to cover the area. This way if access is needed you can just simply open the door. I would also consider some kind of locking mechanism for this door to ensure that it does not open in transit.

#### Airflow:

Airflow is important to keep your equipment cool. Its not enough to have it in an open space. You have to ensure that the air flows in a direction away from the hardware. This may mean a little planning working out which direction you fans are going and making small channels to ensure its effective but the long term gains are worth it.

#### How it will be secured & the materials to be used:

How are you going to secure this whole unit to the car its self? If you're brave enough you may want to simply bolt the unit to either the floor or the wall of the boot. That been said you may not want to do that so you would have to be a little more clever and use items such as the luggage hooks and the back of the rear seats to secure it.

The type of material you may want to use may also affect this. Where possible try and use materials such as metal and acrylics as these do not hold on to the heat as much as wood. At the very least if you have a budget and want to construct with wood try and make sure that you have good air flow and the module is constructed with some thing like one of the above materials to dissipate the heat.

One thing to be aware of if EMF or Electromagnetic Fields, some times if you don't use the right materials you may find that interference noise may be heard. To negate this try where possible to use such materials as metal to shield the main components giving this out. An ideal quick fix could be to re-use an old case and bend it in to shape.





An Example of a Good Fan

### Construction

But how do we achieve this nirvana ? The best way to make sure you get the construction right is to create a template first. Card board boxes are excellent for this as you can cut them as you need and then you can use them to assist in cutting the actual material later on – be it wood or acrylic. It also allows you to get the right look and to make sure that there are no sneaky edges to stop installation. That been said if you are an expert with a measuring tape that is just as easy. One thing to watch for is spaces that are not square or equal. For instance you may want to install your mother board in the space between the tail light and the suspension strut. In many cars case that space is larger that the front than the back, therefore you would have to allow for that fact and bring the mother board forwards in to the boot space more than you want. The ultimate result of this is that you may now need an extra inch than planned for.

As a general rule of thumb the best way is to create the module, then the arrays to go inside of that module and then finally the cage. I would advise you to create the cage in two separate stages as well. The first as a standard shape – either a vertical or horizontal. This would serve as a sub frame and would be the main way to save time and effort should you transfer it in to another car ... why ? Simple – once you have the sub frame it is an easy task to build up on it or add the necessary structuring to make it custom for your own vehicle. Once the complete frame structure is assembled you can then cover it with what ever material is best suited for its situation.

The best way to describe a similar structure and process is an aeroplane wing. It is generally a frame work structure covered over with a light material to make it more aerodynamic and look better, the principle is the same here ( except for the aerodynamic bit ).



Cardboard Template at Work

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## Operation

One of the main points of this concept we have not covered so far is the day to day operation of the kit it's self. Now all of the hardware should be mostly hidden but the problem with that is how do you access the controls ? Well for basic maintenance you may have another power supply indoors for your module it's self how ever for items such as the reset and power buttons and indicators you will need to replicate these. The best way to complete this would be to create a custom connection between the module and the cage with the buttons and LEDs mounted in the cage its self.

This is mainly from an aesthetic point of view should you have the components on show using Plexiglas, how ever there is no reason it can not be integrated in to the module its self.

That been said there is one advantage to creating separate controls which is that a duplicate set can quickly be added using simple electronics techniques allowing you to have a set in the back and even the front of the car. "A waste of time" I hear you say but now and again like any good system you get a problem while your driving and there is no where to stop. Access to the modules and any other area should be easy to do how ever please do remember to add a locking system in to prevent accidental opening.

## An Actual Installation – What happened

The following picture shows the result of a real installation using the CAMM case concept. There are some small alterations to the overall design because as I said before you can individualise your installation as well as the fact that I am a techy rather than an engineer. That been said it was not that hard to actually to do and I fully believe that with a little more practice I would have been able to crack it. In fact you will notice the front of the module was designed to have the minimum on display as I fully intended to have a clear Perspex window that lit up included. How ever for some reason where I live it is very hard to find a supplier of Perspex let-a-lone someone to cut it to the right size and include mounting holes and to order it from afar had the potential for too much hassle.



The Completed Installation In Place

So the first thing that I did was to create a template to see how it would look and fix as well as giving me a 3D model to make measurements from. You will notice that there is a window where the mother board is, this was where I planned to place the Perspex – not really functional more aesthetics. You'll also notice a 2nd slot for the DVD drive. This actually covered so you can't see it installed on the finished product. This just gives the over all unit a 'flush fit' look which again is some thing I personally planned for.



My Cardboard Template at Work

So after going down to the local DIY store and picking up a large sheet of MDF I and one of my family ( who is a carpenter any way ) cut it to fit the space in the boot to give the 'flush fit' look. This was to act as the 'Cage' how ever we did come across one problem which actually enhanced the design in the end.



Making The Initial Cut For The Cage





The boot space actually slopes towards the back of the car so even though it looks level its not. Because of this and only taking one height measurement we ended up removing too much from the top of the panel.



A Test Fitting

The result was that we attached an extra piece to the outside of the main panel to give an extra inch of boot space back – doesn't sound like much but it all helps. This also is inline with the 'Cage' concept as I can simply change this top piece for the next car with out having to reengineer the main panel.



The Cage Panel Carpeted

Here you can see the completed 'Cage' panel but covered with some cheap carpet. Again this is not an issue to change as it's simply held in place by standard screws from the DIY shop; these screws are also covered by simple plastic covers to improve the aesthetics. I also placed a 'doubled over' length of carpet over the end towards the front. This would come in to play later how ever it also allowed for a more snug fit to the back of the rear seats but still be flexible enough to allow air flow and access.

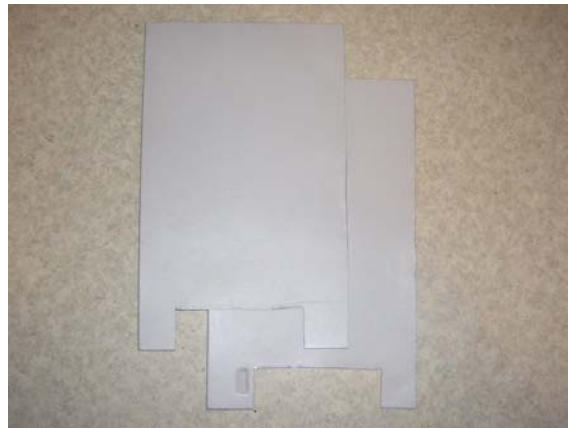


Ok so the 'Cage' is completed, now on to the 'Arrays'. For this I used two sheets of metal which believe it or not is the side of an old Compaq server – the ultimate in recycling.



Marking The Panels Out.

This did take about three days to cut after extensive measuring to make sure they worked together as these would stand back to back rather in line.



Some Hours Later...



Once I got the basic shapes I started to place the hardware on to size up where it would go and to maximise the space as much as possible while at the same time making sure that the air flow was not interrupted. Below you can see one of the early mock-up's I did and as a result the locations did change in the final version.



Before Cutting Any Holes Check Where Components Can Go

After finalising the position of the components I drilled the holes to install the normal plastic Motherboard spacers into the arrays so that they would be held in place.



Another Test Fitting

Finally I created a simple support frame to hold this in place. Again the base was measured to use the space as much as possible for my particular car. Here you can see a test fitting just to make sure that the project so far was correct. Here you can also see the start of the 'module' being created. In case you're wondering the DVD frame is actually the CDROM tray from a DEC server this time. Incidentally you will also see it's all painted up silver again because I intended to place this on show, I simply used acrylic car paint from a spray can.



The Module With The Mother Board Fitted

You can see the 'module' really taking form now with some of the components and the motherboard in place.



A Rear View

One final problem I had not counted on was as a result of me using full size PCI cards for such things as a GSM data card and a custom Nvidia graphics card for wide screen capability. These cards needed some kind of support as they would do in a normal ATX PC case. To do this I simply constructed a large 'U' bar and attached it to the side of the module. Then the cards were simply screwed in to place along with the IR ( Infrared ) port and two further USB ports.





The 'U' Bar In Place



The last job was to secure the Module to the Cage and then the Cage to the car. As the fit was very snug anyway at the end near the entrance to light cluster I then used a simple barrel lock just behind the carpeted area to the right hand side ( towards the rear seats ) which simply slides up to secure that end.



All Done

The air has a small gap just near the light cluster with the fans set up to direct the hot air out of it; this with the carpeted area at the other end ensures that the air flows one way only.

#### Possible Improvements and Additions

What I have described above is a simple concept and like any thing else can be changed, improved or even added to for your own purposes. Certain ideas you could integrate though as those such as having a clear acrylic view port to see the components, these could even be subtly lit up for effect. Further additions could be extra fans or even splitting your system in half and having two CAMMs in the boot but half the size – it's up to you and how creative you can be.



## Websites and Forums



There are a number of web sites out on the web where you can get further information from, <http://www.digital-car.co.uk/> for local UK members and for the international scene <http://www.mp3car.com>. MP3car have a great fabrication area where the taking points include how some one has done an actual install to what the best sand paper for fibreglass is. Have a look and find what is best for you and your skills if you intend to build you own CAMM system.

## My Conclusions

Building a CAMM case is no easy task and it does take planning and a certain amount of skill to do it. A number of areas that are covered in this concept are also used in commercial areas as and such proven to work. What this concept does give you is an easy way to make a case that is custom to your vehicle but in such a way that you wont loose too much of what you have done should you need to change cars or configuration. It does open up other possibilities such as been able to have more than one car and cage and been able to transfer a module to and from ( a bit like a big iPod I suppose ) as well as an additional security aspect of been able to remove the system at night.

Only your time an effort will create the system you want but with luck this concept will give you a head start in creating a really cool looking CarPC system.



An Example Donor Car



## Terran Brown – Biography



Terran has worked in the IT industry for 'Blue Chip' companies since the early 90's on various technical roles from wide area networking, to PC build and server support. Currently he works as a Project Manager for a leading international outsourcing company still working with large 'Blue Chip' customers. It was a result of his technical background that his interest in the CarPC technology grew to the point where he is now of the more recognised enthusiasts from the UK.

His project home site can be found at <http://www.letscommunicate.co.uk/carpc/>

## About CarTFT.com



CarTFT.com was founded in spring 2003 with the goal to offer people a cheap way to integrate computers into cars. As we do a lot of cross-border selling we know that trustworthiness is everything in online business. That's why we try to support the community, offer external insurance for every order, and try to have large stocks to enable shipping of orders as fast as possible. We also try to resolve RMA cases within only days instead of weeks / months where possible.

Our "technical" goal is to offer products which allow the customer to have an open platform and no proprietary system, where he / she can't change anything.

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