THE RUSH CW460 MEGA-BUILD SERIES IS NOW IN FULL SWING AND NEXT MONTH NIGEL PLANS TO COVER THE ASSEMBLY OF HIS BESPOKE AND RATHER OVER-THE-TOP POWERPLANT. (WOULD WE EXPECT ANYTHING ELSE FROM HIM?) WITH THE FINAL DRIVE AND SUSPENSION IN SITU, THIS MONTH SEES THE INSTALLATION OF THE BRAKE AND FUEL SYSTEMS. AS EVER, NIGEL HAS HIS OWN APPROACH BOTH TO COMPONENT SELECTION AND ASSEMBLY, SO SIT BACK, PUT YOUR FEET UP AND ENJOY CHAPTER 4 OF THE CW460'S CREATION.

RUSH CW460

CHAPTER 4

Nigel, Kit Car's Tech' Ed' and in-house builder.

I'm in the zone and life could not be better. It's an extremely intoxicating process building a kit car, especially when its final form starts to take shape. This may seem a little premature considering at the end of last month's update I had yet to fit components such as the brakes, engine, gearbox and wheels, let alone the bodywork but my mind is running about twenty jobs ahead of the current activity. Over the past several weeks I have made critical decisions on lighting, instrumentation, trim, engine bay panelling and so on. Typically for me all are not the standard offerings - my CW460 is definitely going to look and drive like no other Rush. As you can probably sense, my enthusiasm for this creation is growing daily and to be totally honest it has the signs of becoming all-consuming. As you will probably remember in the build-up to this series, 'all-consuming' is somewhere I don't want to be after the emotions associated with my last build, the Tojeiro. Consequently, after a long discussion with my darling wife, two options were laid on the table: yoga in the local village hall on a Wednesday evening or a regular slot at my neighbouring watering hole (The Kings Head public house) where cool, refreshing - um' I mean, calming - medication is always on tap. After seriously considering my options the latter got my vote. I've never looked good in Lycra. Enough about my current mental state, let me update you on this month's progress in the Dean garage.

STOPPING POWER

It is all too easy to get carried away with horsepower. Making a kit car go quickly is not rocket science though it can require very deep pockets. Very little, however, is discussed regarding stopping power. The reason is simple and can be illustrated by comparing these two bar stool comments: 'I'm running 265 ventilated discs up front with twin pot billet callipers' or 'she has the same power-to-weight ratio as a Ferrari 360'. The subject of braking just doesn't do it, does it? Strap your mate into your road missile, however, and subject him/her to a shade over 1g under extreme acceleration and suddenly there is great interest in the credentials of your braking hardware! OK, I guess the point I'm making here is if you up the horses, reciprocate in the braking department.

STANDARD RUSH BRAKING PACKAGES

Front braking
Discs: Ford Sierra 240 mm diameter ventilated discs
Callipers: Ford Sierra 2 pot standard cast callipers

Rear braking option 1
Drums: Ford Sierra drums and shoes

Rear braking option 2
Discs: Ford Sierra 253 mm solid discs
Callipers: Ford Sierra 2 pot standard cast callipers

THE CW460 FRONT BRAKING PACKAGE

The V8 Rush is a relatively light car, probably weighing in at around 60% of a Sierra. Consequently, the use of the standard Ford braking package is adequate for these potent cars providing you opt for discs front and rear. Rear drums are fine if you want to build a sub-100 bhp Rush, but as the absence of a servo reduces system efficiency, the small additional expenditure to upgrade to discs all round is money well-spent regardless of powerplant.

Considering my car has (on paper) a potential terminal velocity of 160 mph - a sobering thought when a couple of people can lift the chassis minus engine and box - a serious rethink was required. Focusing on the front end, the first line of attack was to increase the disc diameter. I was conscious

Wilwood 4 pot callipers and fitting kit - ultimate stopping power for Nigel's CW460.

of clearance issues with the wheel and tyre package so opted for the largest discs possible: 278 mm as fitted to the Cosworth.

These huge ventilated discs are of a cast construction which is subsequently precision-machined. The principle behind their structure (two solid discs separated by vanes) is to aid cooling during high speed retardation. This dissipation of thermal energy is a serious headache for brake designers, and if left unchecked can cause component warpage and brake fade (not good at 160 mph!). To be on the safe side I also opted for every disc upgrade available: cross drilled and grooved. Apart from looking extremely impressive, they have two distinct actions: Cross drilling is basically a series of holes drilled through the disc structure which provides additional heat dissipation and has the ability to remove water and gas build-up under the pads during aggressive braking. Grooves deglaze the pad's surface during use. This glaze is yet another side effect of heat build-up.

The fitment of larger discs has its consequences, the most obvious being the callipers which no longer fit. I was faced with two options: purchase spacers from DAX to allow the relocation of the standard 2 pot variants or go the whole hog and upgrade to high specification semi-race units.

After perusal of the Rally Design catalogue I simply could not resist taking the second option. My final choice was the forged Midilite 4 pot semi-race calliper produced by Wilwood. Fabricated from a drop forged billet of aluminium, these high specification callipers are not only incredibly strong but also light. The four piston configuration ensures significant gains in braking performance, while discussions with Image ensured my wheel design could accommodate the upgrade. Utilising a radial mount, the braking package from Rally Design comes complete with billet aluminium mounting brackets to accommodate the Ford Cosworth upright. With the addition of a set of high performance Wilwood fast road brake pads the order was placed. Perfect.

THE CW460 REAR BRAKING PACKAGE

With the front set-up done and dusted I moved to the rear. The option of going 4 pot on the second axle is not necessary due to the weight of the Rush. The need for separate handbrake callipers also adds additional complexity, weight and cost for no real benefit. I knew this from day one, hence the reason I sourced Cosworth rear hub carriers which allowed for the fitment of large 273 mm discs compared to the standard 253 mm. Due to the lower braking forces encountered on the rear axle I opted for solid discs but still chose cross drilled and grooved upgrades to match the front. To be honest, in this respect, I was mostly concerned with the visual balance of the car. A pair of very rare (and savagely expensive) new Cosworth rear callipers were sourced, along with a full set of fast road pads.

FITTING THE BRAKES

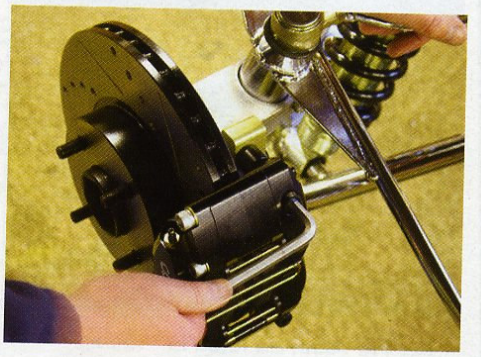
Even though the selection of the brake package took a considerable amount of research, the fitment was quite the opposite. On taking delivery of a rather large cardboard box from Rally Design I laid all the components on my workbench. The Wilwood callipers immediately caught my attention and were in themselves pieces of automotive art. Finished in anodised gloss black, the text 'Wilwood' had been precision milled into the front surface. Simply sublime! Supplied with a selection of high tensile cap head set screws, the entire kit would enhance any project regardless of pedigree. I was eager to start bolting the callipers onto the uprights, but first the ventilated discs needed a little attention. Supplied in machined steel, they would soon succumb to a layer of rust once the Rush hit the highways. Consequently, I meticulously masked off the braking areas and applied a coat of semi-gloss high temperature calliper paint. The painting process itself took minutes; it was the masking which occupied a good half an hour for each disc. When everything was dry the first job was to bolt the billet spacer brackets to the Cosworth uprights. Once in situ the ventilated discs could be slid over the studs. Taking my time to savour the moment, I slid the stunning Wilwood callipers over the discs and tightened the cap head set screws. Finally, the pads were slid home (with a smear of Copper Ease on the back surface to aid future removal) and the retaining clip inserted to keep everything in place. Standing back it was clear my homework had paid dividends: the CW460 looked seriously mean.

Even though the rear discs were larger than standard, the process of fitting the rear brakes was a little less exciting. Once completed, however, the additional cost of upgrading to cross drilled and grooved discs appeared to be an ideal investment.

Step 1: fitment of the billet alloy mounting bracket.

Step 2: sliding the ventilated disc over the studs.

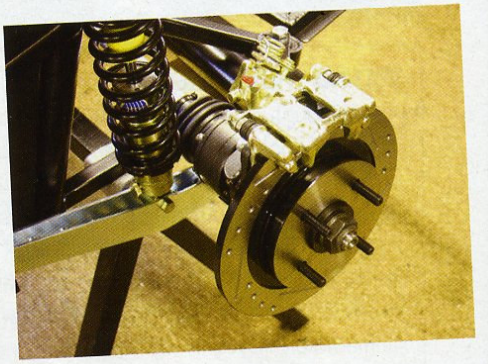
DESCRIPTION	COST
Wilwood Midilite calliper upgrade kit	£425.35
• 2 x Wilwood Midilite callipers	
• 2 x billet mounting brackets	
• Set of Wilwood high-performance brake pads	
• 2 x 283 mm ventilated and cross drilled discs	
• Fixing kit	
Upgrade to grooved discs	£30.55
Rear Cosworth 273 mm cross drilled and grooved discs	£99.66
Rear high performance brake pads	£51.70
Pair rear solid disc Cosworth callipers	£293.75
Rear calliper fixing kit	£4.70
TOTAL	£905.71



Step 3: bolting the 4 pot calliper to the mounting bracket.

All done in a matter of minutes.

Rear cross drilled and grooved disc being slid over studs.



Cosworth calliper in situ.

This cost could be reduced significantly if opting for reconditioned Ford callipers. I would recommend, however, to always invest in new discs, pads and fixing bolts.

SOURCING AND FITTING BRAKES	
Time	26.5 hours
Difficulty	1 – very easy to fit
Cost	£905.71
Tools	Allen keys

HANDBRAKE AND CABLES

Walking into the garage the following day confirmed the hours I had previously spent in front of the PC and flicking through catalogues was worthwhile. The Wilwood callipers and huge discs are absolutely sublime and I was mentally reassured they would arrest my beast when called upon.

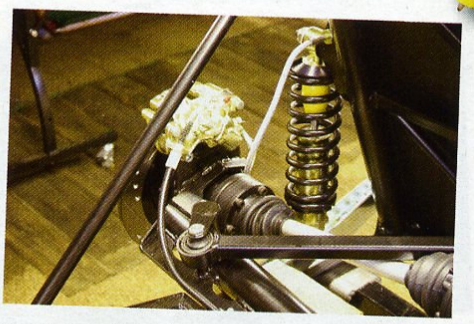
Flicking through the now-rather-grubby build manual I was confronted by an exploded diagram of the handbrake lever mechanism. Oh joy!. Much like fitting a windscreen wiper motor, this is a necessary job, but not a very exciting one. 'Onwards and upwards' (as Big Ed' often says to me), so I switched on the television for some mindnumbing daytime company. Rummaging around in my dwindling boxes of bits I soon discovered my prey. Thinking to myself, 'What would we have done without Ford?' I pulled a new Sierra handbrake lever from under several layers of bubble wrap. Modified by DAX, this little beasty is situated under the steering column out of harm's way, an ideal location in my opinion, since the conventional position between the driver and passenger is a tad awkward when you are squeezed into a small cockpit.

Accompanying the lever was a small bag filled with several fasteners, one a very odd combination of two bolts welded

back to back like two mating dragonflies. Curious as to the need for such an odd item, I scoured the build manual and hidden in a note was the explanation: this item allowed the Sierra handbrake to utilise the same fixing holes in the chassis as the alternative Cortina item. Interesting. Fitting the lever was relatively straightforward, but to ensure the cable (also supplied by DAX) moved freely where it attached required a fair amount of fettling. No big deal, but one of those things which makes a five minute job turn into half an hour of fitting, removing and refitting until the action works perfectly. Another kit car building lesson!

The handbrake cables run under the floor pan which immediately highlighted a problem. My chassis had been modified to accommodate a rather beefy gearbox and, in the process, the central supporting bracket for the cable had been 'hindered' (for want of a better word). Problem was I really needed to fit the box prior to relocating a new bracket. Hmm, it was 250 miles away being mated to my engine! This is another lesson you learn very quickly when building a kit car: dependencies. Try to do one job, and you can't until you do another, which you can't until you do another, which you can't because you are waiting for a part. Phew, bleedin' awful English, but you get my drift!

Not feeling too disheartened I turned my attention to the rear cable runs neatly routed around the De Dion tube and connected to the Cosworth callipers. At least that part was easy, especially with the chassis on stands.



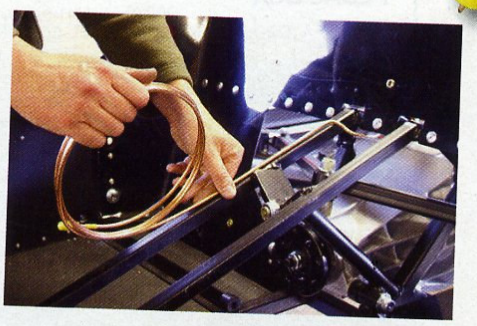
Handbrake cable in place. Note how neatly it is attached to the De Dion beam.

FITTING THE HANDBRAKE	
Time	1.5 hours
Difficulty	1 – very easy to fit, unless you alter the chassis!
Cost	All components previously accounted for
Tools	Hand tools

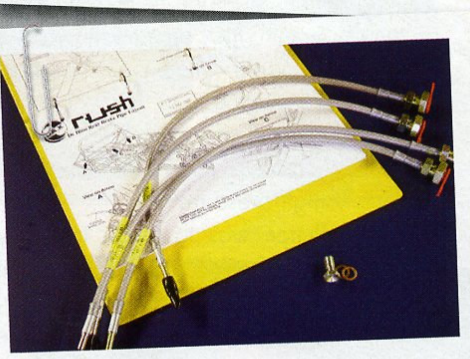
Brake line kit from DAX. Very professional.

SOLID BRAKE PIPES

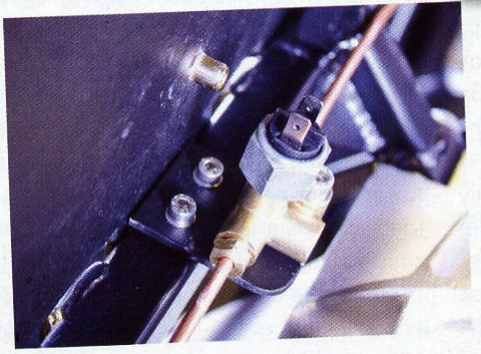
The fitment of solid brake lines is one of those jobs which separates well built kit cars from those which are just average. It's a fiddle, occasionally a cumbersome exercise and one which requires a fair amount of finesse, but if done correctly has its rewards. DAX supply a very comprehensive kit for the job, including all the copper pipes cut to the correct length, thirty professional plastic chassis clips and two unions. It's good to see the use of copper rather than nickel alloy; the latter is fairly brittle and can easily kink. The first step is to locate a three-way brake union at the front of the chassis and a four-way one at the rear. The additional outlet at the rear is for the hydraulic brake light switch, far more reliable than a mechanically-operated alternative situated on the pedal assembly. Each copper pipe is labelled with a unique number which determines its position on the chassis. The build manual recommends the preferred route and deviating from this can cause problems as you only have a pre-determined length to make the entire run. However, I like to hide as many pipes and cables as possible in my builds, and those familiar with the Rush will see I have gone my own way in a few places. In particular I have hidden the vertical pipe runs which usually attach to the end of the driver's tunnel. I wanted to keep this panel as clutter-free as possible, so an alternative route was found for both the front and rear brake circuits. I had to shorten the latter, but luckily I have a flaring tool so this was not a problem. If you also decide to perform such a modification to solid brake pipes always use a 'cutter' (available from Car Builder Solutions) and not a hacksaw. The smallest amount of swarf in the system will block the master cylinder **and cause brake failure**. Utilising a rather neat bending tool (also purchased from CBS), the process of forming a single bend in isolation was simple. What, however, was considerably more challenging was ensuring the pipe runs were parallel to the chassis rails throughout the entire length. This never seems to get any easier from build to build, but I



Routing the copper brake lines. Lots of patience required.



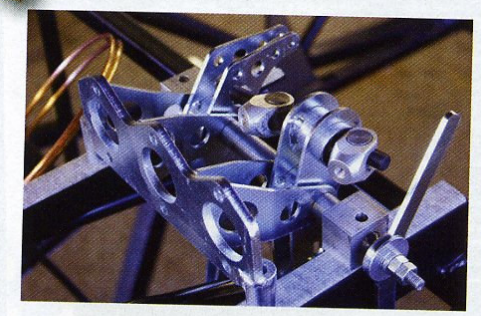
Flexible brake lines to connect solid pipes to callipers.



Hydraulic brake light switch in rear four-way union.

like a challenge! Once the pipes were eventually bent to shape, the plastic clips provided were located in 6 mm holes drilled in the chassis and clipped home. All in all the final result was worth the effort, as I hope the pictures illustrate. Flexible brake lines connected the solid pipes (now located on the chassis) to the front and rear callipers. These too were included in the kit. The only part of the system which could not be finalised was the coupling to the master cylinders. This required the fitment of the pedal box.

Rear flexi pipe being fitted.



Pedal box minus master cylinders.

PEDAL BOX

The DAX pedal box is a rather complex affair and accommodates three hydraulic master cylinders: one for the clutch, one for the rear brake circuit and one for the front brake circuit. Care must be taken to ensure the latter two are not confused, because even though they look externally identical the bores are of different diameters. To allow both brake master cylinders to operate simultaneously, they are tied together by a threaded bias bar. This in turn passes through the top of the pedal and, depending on its position, braking bias can be adjusted to front or rear. Once set up this must be locked by a pin or similar device otherwise it's a guaranteed SVA failure.

The fitment of the pedal box to the chassis requires the drilling of four M6 holes and the insertion of long set screws. I spent a fair time ensuring the assembly was perfectly square to guarantee pedal operation was in line with the driver and would not foul the tunnel side or steering column.

FITTING THE PEDAL BOX	
Time	1 hour
Difficulty	1 – simple
Cost	Parts previously accounted for apart from clutch master cylinder - £141.00
Tools	Electric drill and socket set

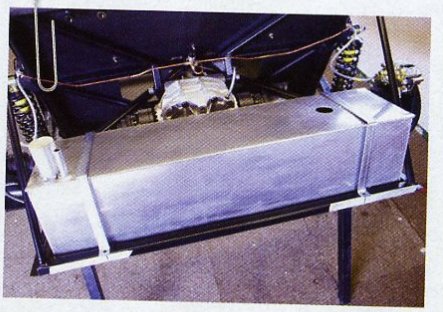
The vast majority of kit car manufacturers produce their own pedal box assemblies and cost savings in this area for a budget build are difficult to make. This is one purchase you simply cannot avoid.

FUEL SYSTEM

Much like the braking system, my rather lavish choice of powerplant also significantly impacted the CW460's fuelling needs. The idea of a basic tank, a single 6 mm fuel pipe, low volume pump and paper filter was far from realistic. My engine is a high capacity fuel-injected V8 that needs feeding with copious amounts of petroleum at extremely high pressure.

The solution was to fit an internally baffled tank of aluminium construction with both an outlet (100 mm in diameter) and an inlet for any returning fuel. Unlike the vast majority of carburettor installations a return is essential to maintain a constant fuel pressure. Mounted on rubber, the tank was neatly seated on the Rush chassis within a small recess. Secured by two large inch-wide straps, there was little risk of the tank coming dislodged in use.

The tank outlet was subsequently connected to a billet alloy gauze filter before feeding the high pressure pump. Making the connections was straightforward, but fabricating the mounting bracket for the pump took a good couple of hours. The reason for this unexpected effort was the need to mount the round pump as low as possible on a chassis member. This awkward positioning was essential since the pump relies on gravity for its feed. This is not unusual for fuel-injected pumps because they are superb at pushing, but incredibly poor at sucking.



Fuel tank mounted in rear of chassis.

The high pressure 8 mm pump output was then fed to another high flow filter before being directed up the centre tunnel towards the engine bay. The return feed (another 8 mm rubber pipe) followed the same route in reverse, finally returning to the tank. The BS stamped rubber fuel hose was attached every 10 cm to the chassis with cradle seats and straps. This is the first time I have used this technique instead of plastic 'P' clamps but the end result is extremely satisfactory and compact.

Prior to the engine being installed I terminated both fuel lines with AN anodised connectors. These not only stop any debris entering the system, but also allow the use of Aeroquip (or similar) stainless braided hosing within the engine compartment.

DESCRIPTION	COST
Fuel tank	£311.38
Fuel-injection pump	£146.20
Pre pump filter	£46.30
Post pump filter	£17.92
Fuel pipe and AN terminators	£41.13
Saddle clips and ties	£17.63
TOTAL	**£580.56**

This cost could be reduced if you go the carburettor route and avoid AN connections. However, there is no avoiding the main cost: the fuel tank.

FITTING THE FUEL SYSTEM	
Time	10 hours
Difficulty	2 – straighlforward
Cost	£580.56
Tools	Rivnut tool, selection of hand tools

Fuel pump, filters and pipe.

Pump and filter mounted to rear of chassis.

Running supply and return fuel feeds through centre tunnel.

THE END BIT

That's it for this month. Remember to visit my website www.nigeldean.co.uk for lots of additional images of the build. As previously mentioned, next month I'll be covering the creation of the mega powerplant. Handcrafted by RPi Engineering, in Chris Crane's (MD) own words, 'Your Raptor F8.5 V8 is the best engine my company has ever built.' You will have never seen anything like it, I promise, so the article should make for fascinating reading and will include lots of pictures; I took over five hundred when the unit was built by Holly, RPi's master craftsman, so my biggest headache is sorting out which ones to include. Here's a round-up of the costs and time invested so far:

Nigel's Rush CW460 patiently awaiting its engine.

BUILD	ACTIVITY SUMMARY	TIME (HRS)	COST
Part 1	Order build packs 1 - 5	0	£5,434.00
Part 2	Source and prep donor parts	8	£1,410.15
	Collect build packs from DAX	8	£75
	Chassis preparation	3	£0
	Panel chassis	24	£0
Part 3	Fitment of final drive and suspension	48	£0
	components		
	Research into non-standard items	20	£0
Part 4	Research and fitment of braking system	26.5	£905.71
	Handbrake and pedal box	2.5	£141.00
	Fuel system	10	£580.56
TOTALS TO DATE	150	£8,546.42	

TEENAGER'S TAKE

Hi there again, budding kit car fans! It's me, Evie Dean. So what's happened this month? Well, firstly, the car is in danger of not being the main attraction at our house at the mo. We have another baby! A puppy called Pip.

Mum told Dad that Pip couldn't possibly roam around the garage with the floor littered with nails, sharp metal, screws and anything else small enough to swallow, as the little monster (Pip, that is, not Dad) is very fond of chewing at the moment. As soon as Mum said this and he realized he was on pup duty the next day, Dad had a playpen constructed within twenty minutes. Amazing, but I guess it was either that or clear the floor.

So, humans aren't the only ones being taught/bored to tears about Dad's car... oh no. The puppy has had his fair share as well! Now he knows about valves, camshafts, brake pads, engines and even the variations between different lights. Yes, this must be the cleverest dog in Britain!

It's not only Pip who has had his fair share of kit car project number 7. Following a car show last weekend, Dad came home with all sorts of goodies /junk. You should have seen him, he was like a little boy. The purchase that excited him the most were some lights. Trust Dad. He couldn't have lights with just one bulb in them, oh no. He had to have the eight bulb versions instead. Every visitor to our house has been shown and given a detailed explanation of the LED back lights, including an Arabic friend staying with my grandparents. The look of bemusement on his face said it all really! What's so exciting about some lights? I just can't get over how thrilled Dad is about them. Wow, a multi-bulb light. How interesting. Give me music any day. Actually, I've just had a thought...

'P-i-p! Want a nice new chew toy?'

Nigel's daughter, Evie, with another of her Teenager's Take.