DIFFERENTIAL TYPES:
The XJ - S has apparently been fitted with at least two different differentials ("final drive units" for you Brits). From 1976-1985, the differential was a Salisbury 4HU Powr-Lok that came with either 3.07:1, 31:1 (1976-1982), or 2.88:1 (1982-1985) ratios. From 1985-1987, a 2.88:1 Dana unit was used. Now, follow closely, From 1987 to 1993, the XJ-S was fitted with a GKN Power Lock differential with a 2.88:1 ratio.

The 87-93 differential is essentially the same item as the pre-85 differential (a speedometer sender was added; see page 593). According to Richard Griffiths, in the meantime Salisbury had been bought out by GKN. Later, GKN was bought out by -- wait for it -- Dana! But this was apparently after the XJ-S changed to outboard brakes. Dana (http://www.dana.com) grew to be a huge corporation with annual revenues in the billions. In this book, we will use the same convention that is commonly used among Jaguar owners: the pre-85 unit and the 87-93 unit will be referred to as a “Salisbury”, regardless of whether it was actually made by Salisbury or GKN. The 85-87 unit will be referred to as a “Dana”.

From 1993 on, the entire rear end of the XJ-S changed. A suspension similar to that on the XJ40 was used, with outboard brakes rather than inboard. Along with the engine being enlarged to 6.0 litre and the fitting of the 4-speed GM 400, a 3.54:1 final drive was used.

Apparently the AJ6-powered XJ-S’s, 3.6 or 4.0 litre, all have 3.54:1 final drives. All XJ-S differentials are “limited slip”, although the feature has often been given different names. The official Jaguar service department repair procedure for final drive units is to replace them as a whole. SALISBURY VS. DANA: Differences between the Salisbury and the Dana include:

- The Dana has no drain plug.
- The input flange on the Salisbury is circular. The input flange on the Dana is rectangular.

With the Salisbury, the inboard brake calipers are bolted to lugs on the flanges holding the output shaft bearings, with the bolts installed from the inboard side outward. With the Dana, the inboard brake calipers are bolted to bosses on the case itself, with the bolts installed from the outboard side inward. In order to access those bolts, the Dana is fitted with brake rotors with access holes.

The limited slip internals of the Salisbury are the “disc type”, while the limited slip parts of the Dana are the “cone type”. Greg Wells of Coventry West says the gears from a Salisbury will not fit the Dana case.

DANA QUALITY:
The Dana unit has a bad reputation. Apparently, the lack of a drain plug and the fewer bolts on the output shaft bearings gave an initial impression that it was “cheap”, and Jaguar’s return to the
Salisbury unit after three years convinced many that there was something wrong with it. However, there's no telling what supply problems Jaguar was dealing with in the mid-80's, especially with a buyout going on at Salisbury, so there may be other explanations for the flip-flop. Apparently, the real problems with the Dana are not in mechanical shortcomings in the unit itself, but rather in support and maintenance. Ian Hissey says, “I have just removed the Dana diff from my XJ-SC, and replaced it with an overhauled Salisbury. A number of reasons, including changing from 2.88 ratio to a 3.31 ratio, but also, here in Aus the cost of replacement bearings, etc., for the Dana was extortionate, more than double the Salisbury, and also the Dana is not a true limited slip, has a cone arrangement, which is not as effective as a Salisbury LSD.” Note that Hissey’s preference for disc-type limited slip over cone-type is not universal; it’s apparently a good topic for argument among performance buffs. Greg Wells of Coventry West says, “The main problem with the Dana as we see it is that it is different and requires special Dana-style rear brake rotors.” Note that the only difference between the rotors used with the Dana and the rotors used with the Salisbury are the access holes, so the Dana ones could be used on the Salisbury. It would therefore make sense to stock only the Dana style, but Wells says the ones with holes cost significantly more than the ones without holes so they stock both. Obviously, you could buy the cheaper Salisbury rotors and drill access holes in them for use on a Dana. “That, plus the fact that it doesn’t have a drain plug and people thus change the diff lube even less often compared to the Salisbury. Our rebuilder, Dick Maury, says that the L/S clutch setup in the Danas is not quite as good as a Salisbury in his opinion and that the carrier may not be as strong, but he also points out that we have seen Danas in 6.0L TWRs, so they obviously can handle the power.” Apparently, the items that fail on the Dana are “those silly little clutch retainers”, whatever that means.

DANA DIFFERENTIAL SERVICE:
When working on a Dana unit, you can get the seals from Jaguar, bearings from a local bearing house, and the clutches, shims, and those silly little clutch retainers from any performance shop that has access to Dana rear end parts. When ordering, they will usually ask for a ring gear diameter and an “axle” spline count.

DIFFERENTIAL BREATHER:
John Goodman reports on special parts for the XJR-S: “Looking through the parts list I notice that there is a revised diff cover with additional baffles. <Quote manual> ...“the diff rear cover is redesigned to improve breathing at high road speeds. The altered baffle plates direct oil flow so that turbulence is kept away from the oil breather.””

DIFFERENTIAL OIL CHANGE:
Getting the fill plug out is no picnic. It has been suggested that removing the center reinforcing plate under the final drive unit (14 bolts, 6 with nuts) may be worthwhile. Don’t worry, the whole car won’t fall apart while the plate is out. Many Jag owners suggest a length of plastic hose and a squeeze bottle for topping up or filling up the final drive unit. The hose should be long enough to feed out the right side wheel well so the oil can flow downhill.
Brian Sherwood points out that if you open the boot, remove the spare tire, and peel back the matting forward of the fuel pump, there is a round metal plug; removal of this plug provides access to the fill plug on the differential. “I just popped it out with a screwdriver, did my lube thing, then pressed the plug back in with some RTV around the edge.” Note that while the diff can be topped up with conventional gear oil, a drain and refill requires an additive for limited-slip
units.
According to a salesman at Quality Jaguar, the XJ-S final drive unit uses both natural leather and natural rubber seals. Therefore, synthetic lubricants are not recommended. It is recommended that synthetics be avoided in the special additive as well.

DIFFERENTIAL GASKET:
British Auto USA offers a differential cover gasket (part number 3931) that is supposed to be better than the original -- thicker and better material. TEFLOM: Dennis Hurvitz reports: “While having a quickie lube joint change the oil in my wife’s car (ok, I was pressed for time), a guy pulled up in an older Mercedes to thank the manager. Seems the Mercedes guy had a differential whine and the manager recommended replacing the differential fluid with some new mixture containing teflon. The owner made a point of thanking the manager, because the problem (sound) mostly went away!!” Unfortunately, lubricants containing teflon are not recommended for limited-slip differentials, and all XJ-S’s have limited-slip differentials. Still, if you’re facing a diff rebuild anyway, perhaps you can add the teflon to quiet the whine and do without the positraction until you get around to having the diff rebuilt.

INPUT FLANGE RETAINING NUT:
It’s a really big nut, obviously it should be tightened down really tight, right? Wrong. This nut is used to set the preload on the input shaft bearings. Between the bearings is a “crush sleeve”, and during assembly this nut is tightened just enough to provide the proper bearing preload while compressing this sleeve. If the nut is overtorqued, the entire final drive assembly must be torn down to install a new crush sleeve.

REPLACING THE INPUT SHAFT SEAL:
The instructions are in the service manuals, but I’ll repeat the main point of trouble here: When you’re done, the big nut does not get torqued! It gets returned to exactly where it was before, which means you must mark where it was before you touch it! Once properly marked, the rest of the job is reasonably straightforward. Mike Morrin fills in some details: "Holding the flange was no problem, the handbrake did the job perfectly. "I don't think the splines should have locktite on them, they are fairly tight to remove anyway. It is however a good idea to put a little silicone sealant on the last bit of the splines in the flange to stop oil from creeping out along the splines. I also applied a little silicone sealant around the periphery of the seal. "The new seal I fitted was marked "National USA 9316" and "S-10048-1-28". The new seal is neoprene, the old seal was leather (no wear on the shaft at all). "Overall, it is a relatively easy job (particularly with the car on a hoist), but I think you do need a small puller to get the flange off the splines."

DIFFERENTIAL OUTPUT BEARING FAILURE:
One of the common failure modes of the Jaguar differential unit is the failure of the bearings in the output shafts, possibly because these bearings take lateral loads imposed by the working of the suspension. Whatever, the failure is usually indicated by clunks from the rear when driving or the tire rubbing the wheel well where it formerly had clearance. Checking by grabbing the top of each rear wheel and shaking vigorously in and out clearly indicates a problem. Closer inspection shows that the output shaft is free to move in and out, and the only thing limiting movement is the brake
disk banging back and forth within the caliper. According to Jan Wikström, “it’s very likely that all you need to do is replace the bearings and seals. This is not difficult, but you’ll need to take the rear subframe off your car. You can do it from underneath, but that probably takes longer because of the difficulty in getting the brake calipers off and back on. Besides, taking out and dismantling the complete rear suspension gives you a great opportunity to check everything.” The output shaft assembly for the Salisbury differential is available as a pre-assembled unit under a single part number: AEU1802 for the right side, AEU1803 for the left. This simplifies repair considerably; by getting this assembly pre-made, the mechanic doesn’t have to fiddle with bearing preload, crush sleeves, etc., he just removes the old assembly and bolts in the new. Obviously, there is a core charge on the old assembly, so it can be rebuilt with new bearings and seals.

CLUNK:
Julian Mullaney shares an unpleasant experience: “I had a clunk on my ’87 XJ-S from the rear end. My clunk was because the diff itself was loose in the mounts. The mounts in this case were 4 cone-shaped bolts which attach the inner lower wishbone mounts to the diff casting. The bolts screw right into the diff, and are wired in place. These bolts had just become a bit loose even though they were still wired together from the factory. The constant rocking with power on/off had worn the fit between bolts and casting. You can easily check for this by jacking the car up high, putting the trans in P, crawl under and look for movement in the joint while violently rotating the rear tires back and forth.” This is reportedly a fairly common problem; it should be noted that proper torquing and lockwiring of these bolts is very important. Many owners use Loctite on the threads as well. Jan Wikström adds, “If the PO has omitted the security wires on the bolts, they come loose - and then the U-shaped shims fall out and the diff is really loose. “The inner pivot bracket is shimmed to the diff to line up with the pivot mounting holes in the cage; with the bolts tight, the pivot spindles should slide in and out easily. If those inner pivot carriers aren’t correctly shimmed, it’s jolly well impossible to get the trunnion bolts out without slackening the diff bolts - which is very hard to do because the trunnion bolts block access to the bolt heads. You need a very thin open-ended spanner.” “My second XJ had pivot spindles that couldn’t be moved; somebody had botched the assembly and just forced the whole thing together without shims. I had the devil’s own time finding a thin enough spanner to loosen the mounting bolts enough to slide the spindles out.”

“To get this right requires an extra step in the assembly procedure: you measure the space between brackets and diff (bracket mounting bolts finger-tight, bottom plate out) and get spacers to that thickness. Now, there’s not a hell of a lot of space between the suspension arms and the bracket-to-diff bolts; unless you have some extremely thin spanners (and thin fingers to get the locking wire on), you now need to pull the inner pivot spindles. Put the spindles back in without the suspension arms and tighten the bejusus out of those bolts (the torque is in the book); now try the inner pivot spindles. If they don’t slide out easily, you need to tinker with those shims. Apply lock wires and assemble the inner pivots. “Now bolt on the bottom plate; you’ll find that the complete assembly is rigid. “Another thing I noted on that car was that the final drive had been flopping around to such an extent that the rear sub-frame was fractured on top, where the four top final drive mounting bolts are (invisible without taking it out). There’s a (1/4 in? 5mm?) steel plate inside the double-walled top of the sub-frame (as I found when I welded fatigue cracks in my first one); the retaining bolt heads have an underside taper matching a taper in this plate. With your diff slopping back and forth, there is good reason to suspect fatigue cracks in the top.”

FINAL DRIVE RATIO CHANGE:
There are many ratios available to fit the Salisbury final drive. However, be aware that if the ratio is changed significantly, the differential carrier will also have to be replaced. Since the lower ratios (higher numbers) require a smaller pinion, the ring gear needs to move closer to center to mesh properly. This could be accomplished by making the ring gear thicker or adding a spacer, but instead a replacement carrier is used with the mounting flange in a slightly different position. Unfortunately, the carrier costs more than the gears. If you have the Dana final drive unit, Greg Wells of Coventry West reports that he can only get one set of gears to fit: 2.88:1. So, step #1 for changing the final drive ratio is to replace the Dana unit with a Salisbury. Wells adds that, thanks to the popularity of that change, Coventry West can no longer offer core credit on Dana final drive units -- they have more on hand than they can use. So, changing the final drive ratio on a Dana-equipped car means buying an entire new Salisbury final drive unit outright and simply discarding the Dana -- an expensive proposition indeed.