COVENTRY'S CONCEPTUAL CAT

Jaguar slinks into the supercar ring with the XJ-220

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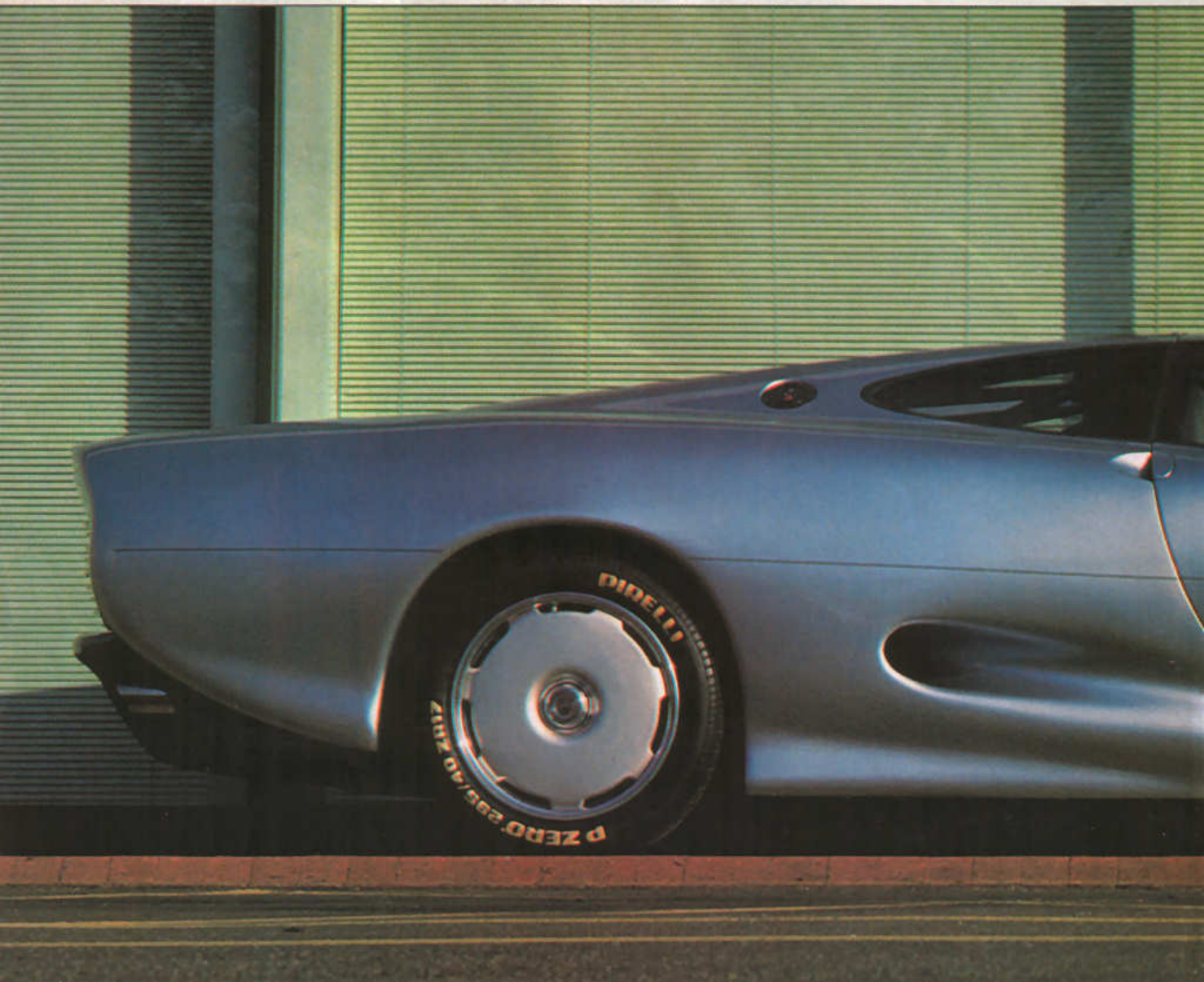

CHANCE HAD IT that the Jaguar XJ-220 exactly faced Ferrari's F40 at England's Birmingham motor show. The crowds of excited enthusiasts swarmed around those two 200-plus-mph cars and hardly knew which way to turn their heads.

Hyper performance, two seats and a centrally mounted engine are just about all these two cars have in common, however, for their philosophies are entirely different. The Ferrari is essentially a racing car, detuned just enough for the requirements of ordinary traffic. It is the most stark machine anyone would accept in exchange for fabulous performance. The Jaguar is a completely different approach. Though only a concept car and not even a runner at the time of its motor show introduction, the XJ-220 is designed to be a comfortable, ultrahigh-performance car, usable under a variety of conditions. And whereas the Ferrari is entirely based on current racing-car practice, Jaguar's XJ-220 embodies new technologies, such as a bonded aluminum structure and a novel 4-wheel-drive system.

According to Jim Randle, Jaguar's engineering director, the project started as an exercise for a small team of engineers. Their brief was to design a car within FISA Group B regulations that would project Jaguar tradition into the future. This meant that the car had to be practical enough to warrant a (purely hypothetical) production of at least 200 units, yet could be turned into a very competitive racing car with modifications allowed by Group B. Of course, the car was to be based on Jaguar's V-12, a powerplant that clinched two world-championship titles for Tom Walkinshaw's Jaguar team in endurance races and won the 1988 Le Mans. In addition 4-wheel drive was a given, so the car's performance could be exploited safely under adverse conditions. And this, in turn, implied that the structure was to be as light as possible to achieve the 1300-kg

The XJ-220's lower bodywork might have come from another automaker, but that lovely side window line is pure Jaguar. And this cat is fully grown: 202.0-in. overall length on a wheelbase of 112.0 in.

The XJ-220's engine bay echoes with Jaguar's racing technology. Dual venturis beneath also reflect the car's track heritage. But its completely finished interior suggests that this concept car is ready for the road as well.

(2866-lb) minimum weight target (once all the luxury items had been discarded) imposed on Group B cars of more than 5.0-liter capacity. Thus, Jaguar decided to base the car on a stressed aluminum structure developed in cooperation with Canada's Alcan International Ltd. (See "Ferrari 408," R&T, December 1988, for another car displaying Alcan's innovative technology.)

The main feature of this structure is its adhesive bonding that ensures better rigidity than conventional spot-welding because loads are distributed over the whole area of the joint rather than at a series of junctions. The Jaguar's monocoque is entirely made up of sheets of 5754 aluminum-magnesium alloy, a material that has excellent corrosion resistance and fairly high strength. It does not easily lend itself to forming, however, so most of the panels forming the structure are flat. These panels are adhesive-bonded and also assembled with a few spot-welds, mainly to retain them in position during the manufacturing and curing process. The entire assembly is designed so that the joints are stressed essentially in shear, exploiting the strength characteristics of adhesive bonding. The outer body panels are also of aluminum and, ironically enough, are handbeaten by craftsmen at the Park Sheet Metal Co of Coventry.

The only structural parts made of steel are tubes forming the windshield pillars and roof rails, which double as a rollcage. All glass areas are of the laminated type and tinted, the windshield and rear window being real works of art supplied by the Triplex Co.

There is no question that the XJ-220 is a big car, especially considering it is purely a 2-seater: Length is 202.0 in., width 78.7 in., while the wheelbase is 112.0 in. Striking as the car's flowing lines are, the most interesting part of the body is its underside, designed to form two venturis on either side of the central tunnel and the engine's oil pan. This, of course, is to generate downforce by ground effect, as is current practice in Group C Sports Prototypes. Additional aerodynamic aids are an adjustable airfoil under the front air intake, another airfoil at the rear across the floorpan venturis, and a retractable airfoil on the rear deck. This can be adjusted from the driver's seat to any of three positions but will be automatically controlled once development tests indicate the best relation between car speed and airfoil position.

The drag coefficient of 0.38 may seem rather undistinguished for a car of this kind and length. But consider it in light of the 1.0 downforce coefficient, which, at the car's maximum speed, produces a downforce of more than a ton, as measured in the wind tunnel. Randle says that if the car were to be produced, its bottom would be modified to reduce this downforce in favor of lower drag. In race trim, C_X improves to 0.35 and the downforce is increased by 50 percent, thanks mainly to the lower ride height that can be used.

The car is luxuriously equipped. Its "butterfly" doors, opening like those of a Lamborghini Countach, are power-operated and so are the fully retracting side windows. Front and rear windscreens are electrically heated and so are the seats, which also feature electric adjustment of lumbar support. There is a central

Its doors open in Countach fashion, but actuation is power-assisted. And a wealth of other details, the headlight fairings, the door handles, the bodywork's side scoops, are uniquely XJ-220.

locking system, remote-controlled by infrared signals, a premium sound system with compact disc player and air conditioning—a must with such large and steeply raked front and rear screens. Interior trim is highest-quality soft Connolly leather, and all the instruments (strangely enough, supplied by the Italian company Veglia rather than Smith) are analog and in the best Jaguar tradition.

Apart from its aluminum construction, the most interesting part of the XJ-220 is undoubtedly its powertrain. The 6222-cc V-12 engine with a bore of 92.0 mm and a stroke of 78.0 mm is based on the standard XJ12 aluminum block. However, its 4-valve-per-cylinder aluminum heads, each featuring twin overhead camshafts, are completely new and have much in common with the 4-valve heads assayed in Jaguar racing engines at the end of the 1988 season. The engine features multipoint sequential electronic fuel injection and a distributorless electronic ignition with 12 separate coils mounted directly on each of the 12 plugs. Compression ratio is 10.0:1, and though maximum power is officially announced as "over 500 bhp" at 7000 rpm, Randle says that 530 bhp is nearer the mark, maximum torque being "over 400 lb-ft" at 5000 rpm. That "only" 85 bhp/liter are developed with 4-valve heads indicates that this must be quite a flexible and tractable engine and by no means a racing unit. This, I believe, is fully in keeping with the whole philosophy of the car, designed primarily as an ultrafast, but comfortable road car.

Befitting its XJ-8 and XJ-9 heritage, the XJ-220's engine is mounted just ahead of the rear-wheel axis, with the transaxle just behind. The 5-speed gearbox is driven through a twin-plate clutch and features dog engagement, though a synchromesh box also has been designed and would be normally fitted to the road version.

Though its principle of 4-wheel drive is pretty straightforward, as devised by FF Developments, the XJ-220's layout is highly interesting and ingenious. The gearbox output shaft drives a viscous-coupling-controlled epicyclic-gear differential. The latter splits 69 percent of the input torque to the hypoid rear final drive incorporating a bevel-gear differential with viscous control unit, while 31 percent of the torque is fed to the front final drive via a transfer box incorporated in the transaxle. Particularly clever, however, is the routing of the front-drive torque: As is well known, Jaguar's V-12 features an auxiliary shaft above the crankshaft, which, in production models, drives the ignition distributor. In the XJ-220 engine, the ignition system is distributorless and the auxiliary shaft is replaced with a shaft taking the drive from the transfer box to the front of the engine. There, it carries a universal joint, and, from there, another shaft takes the drive to another universal joint at the front hypoid final drive.

The final-drive unit is carried by a subframe allowing the entire front suspension and drive unit some fore-and-aft compliance. This subframe is linked to the engine by an aluminum girder, rubber-mounted front and rear, with two bearings supporting the central part of the driveshaft. This configuration avoids the use of excessively long shafts, which might have had distortion problems as well as a comparatively low critical frequency resulting in undesirable noise.

As in racing cars, the rear suspension of twin-transverse A-arm type with coil springs and concentric dampers is anchored to the transaxle unit. However, the engine and transmission are rubber-mounted and are not part of the stressed structure. The powertrain's mounting in the chassis midsection is rather similar to that of the front-engine XJ6's differential housing, and allows some fore-and-aft compliance to improve the low-speed ride but firmly locates the unit in the transverse direction. The comparatively high location of the drive to the front wheels requires a high central backbone, effectively dividing the car's interior into two separate cockpits. However, this also plays an important role in the XJ-220's beam stiffness and serves as an interior console carrying auxiliary controls.

The outboard-mounted, vented disc brakes feature alloy 4-piston fixed calipers and integrated ABS. The system operates at high pressure with an electrically driven pump. Tires are 295/40ZR-17 Pirelli P-Zeros on 11-in.-wide rims.

The original concept of the XJ-220 was laid down three and a half years ago, with Randle relying on the enthusiasm of a group of 12 designers and engineers who volunteered to work on the project on their own time. The styling was done entirely by Jaguar under the direction of Keith Helfet. Most of the aerodynamic development work was done on one-quarter scale models using the MIRA wind tunnel, and much of the car's actual construction was carried out by Jaguar suppliers.

The actual show car, which was literally completed only hours before the opening of Birmingham's show, will be made into a runner first and then developed into a fully operational prototype. It will certainly be used as a test bed for new technologies particularly suitable for high-speed cars, such as 4-wheel steering (for which provision is made in the design) and microprocessor-controlled damping.

Not surprisingly, everyone involved in the project hopes that the car will be put into production. However, nothing has been decided as yet. One thing is certain: If the XJ-220 were to become a regular Jaguar model, it couldn't go into production before the mid-Nineties.