Innovative technology for tilting engine test beds

In France, PSA site at Carrières sous Poissy is one of the research centres of PSA Peugeot Citroën group. It groups a large number of engine test beds. PSA wished to be equipped with a tilting test bed in order to simulate, by the slope of the engine, acceleration and vehicle angle. This test bed allows to study upstream oil separation and lift-off in development projects.

**Objective**
To design a tilting engine test bed (220 kW/550 N·m) to carry out oil separation and lift-off tests by simulating the slope (rolling and pitching) of the vehicle.

**Solution**
To adopt a technology of spindle electric jacks assembled in hexapod which allows 6 degrees of freedom for engine positioning (± 50 °).

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**Preliminary investigation**

After a preliminary investigation phase, D2T chose the hexapod technology, which has never been implemented for an engine test bed. This development was made in partnership with Symétrie (France).

The full accessibility around the engine and the easy loading engine trolley were deciding factors for the choice of this solution.

The higher platform holding the engine, the dynamometer as well as versatile fluid circuits can be inclined to ± 50 ° along X and Y axes. For such angles, a new D2T Eddy current dynamometer, DE220 SW (550 N·m; 220 kW), was designed in order to accept slopes.

This dynamometer was designed with an integrated in-line torquemeter, which provides a reliable torque measurement whatever the test bed tilting angle. The angle change of the upper platform makes the move of the engine on its trolley by the compression of hydroelastic shock-mount. This produces a shaft line misalignment, which may go as far as to break the transmission and damage the engine.

The connecting shaft line was a top priority subject and reached to precise recommendations for the engine mounting on the trolley in accordance of the shaft line used. So D2T know-how with regard to project management, engineering and shaft line studies make it possible to place ancillary equipment around the test bed: fluid conditioning, electrical power, fluid regulation. The project was shared into several parts (civil engineering, distribution, mechanical work, electrical engineering and so on), and each field of activity has been widely studied in order to carry out the test bed tilting particularity. D2T manages all the project parts.

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**D2T DE220 SW dynamometer**

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**D2T DE220 SW dynamometer in action**

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**IN ACTION ON SITE**

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The whole test bed and regulations are controlled by our MORPHEE system. The processing is 100% automatic; it guarantees time saving and productivity. Also that provides a great flexibility in the definition of new tests by the customer. Several safety devices (fire protection, safety or security of people) assures an excellent reliability.

### Conduct of the tests

The test begins by a control and knowledge-building phase during which the operator monitors the hexapod motions and checks that no collision hazard with the test bed devices is possible. Then the operator starts an automatic test list, which consists of collecting different engine parameters (temperature, pressure...) in accordance with rolling and pitching angles defined beforehand in a MORPHEE set point table.

### Conclusion

Rising to this challenge meant the customer had to place their trust in D2T's multidisciplinary competencies, which enabled us to overcome easily the difficulties imposed by the project constraints: precision and positioning repeatability, specific dynamometer, vibration, structure and shaft line calculations.

Our automation system MORPHEE, associated with several control accessories, maintains a fully automatic operation of the whole test bed safely. The test bed sizing, in terms of power, can receive, if necessary, more powerful engines. D2T tilting test bed is an innovative principle on many levels: inclination by hexapod architecture, exhaust gas cooling in the upper platform, fluids circulation from the lower and upper platforms. The hexapod, by releasing workspace around the test bed, allows a very fast change of the engine.