



TP 400 Test Data Storage and Exchange System

Jean-Philippe GOUBE

Jean-Philippe GOUBE

Technical manager of Dynaworks product

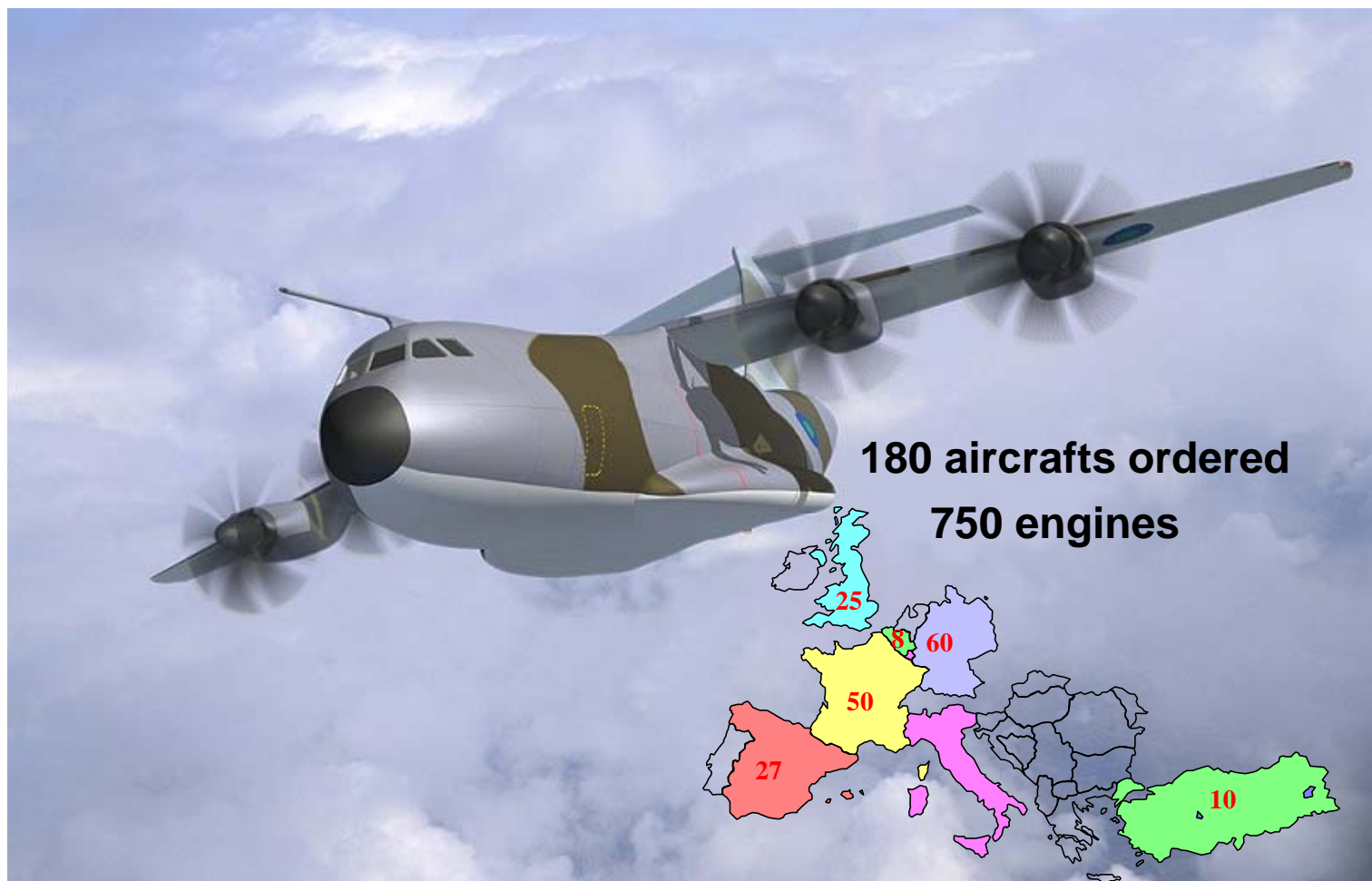
TDSSES project manager

Email : jean-philippe.goube@intespace.fr





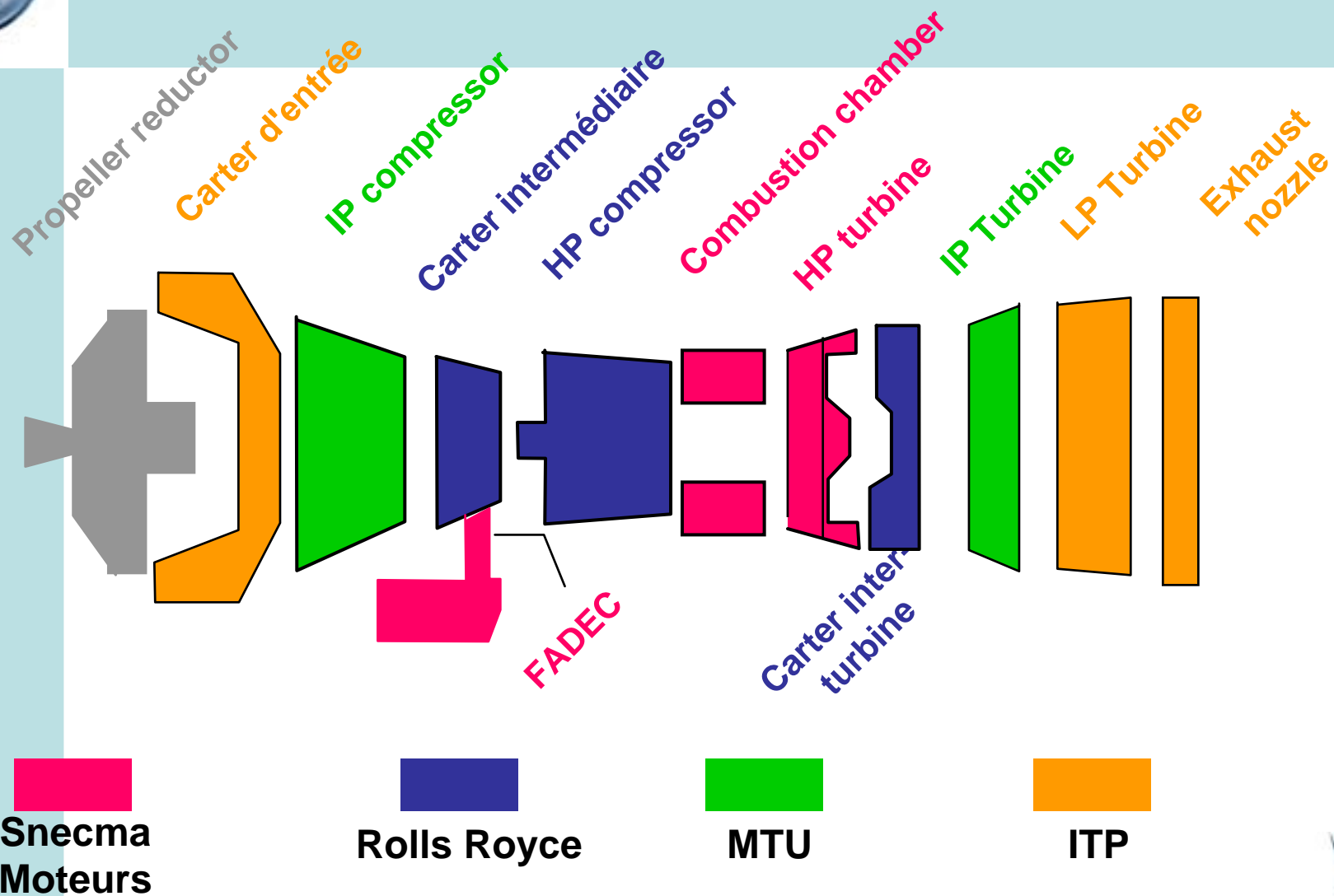
TP400 Workshare



**180 aircrafts ordered
750 engines**



TP400 Workshare





TP400 test issues

The test and design being spread over all Europe, the challenge was to build an

- **easy-to-use,**
- **powerful,**
- **reliable**

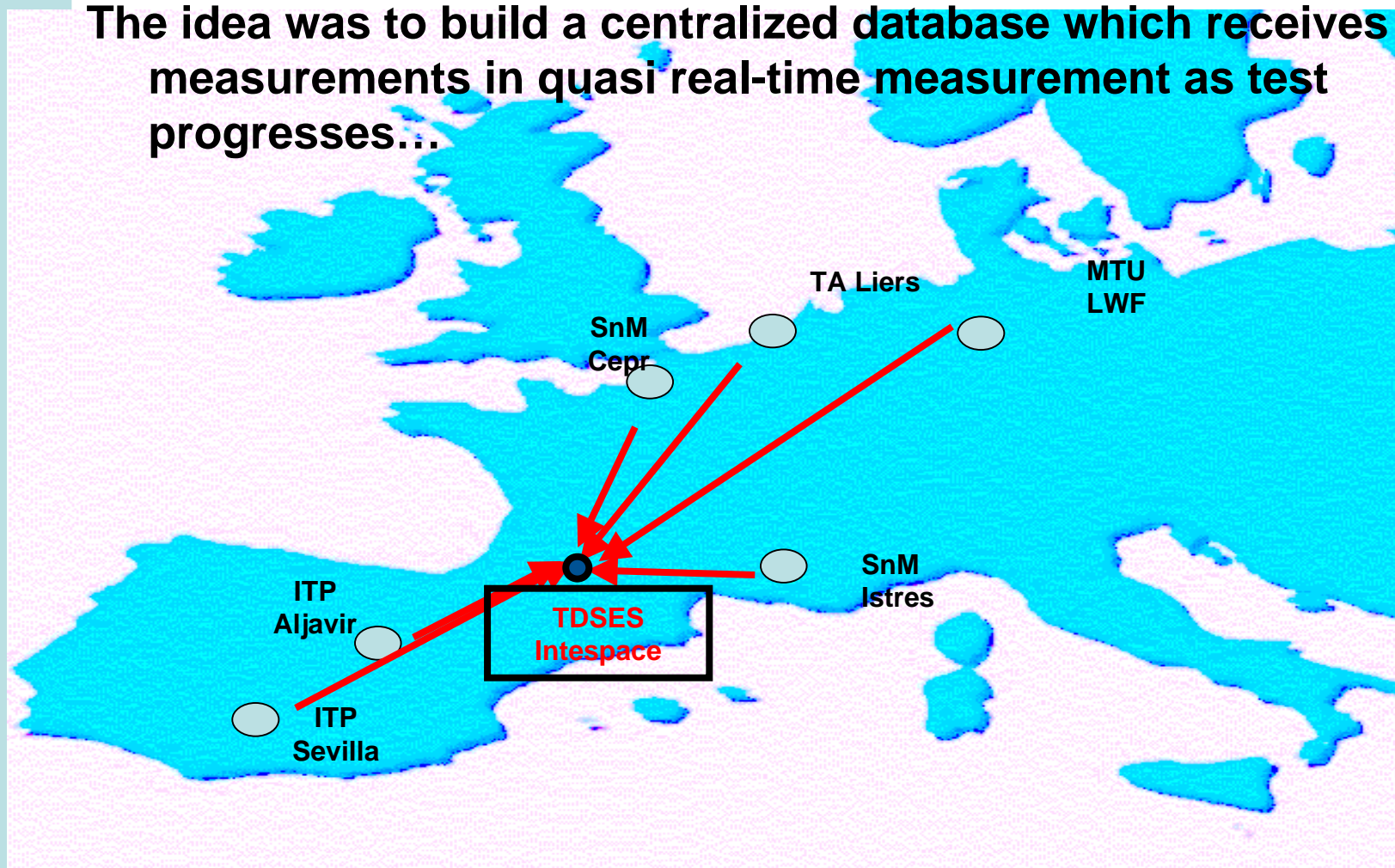
system to allow test data exchange between Snecma, Rolls-Royce, MTU and ITP, and the different test sites : CePr near Paris, TechSpace Aero near Liege, Snecma near Marseille, MTU near Berlin and ITP near Madrid and Sevilla





TP400 test workshare

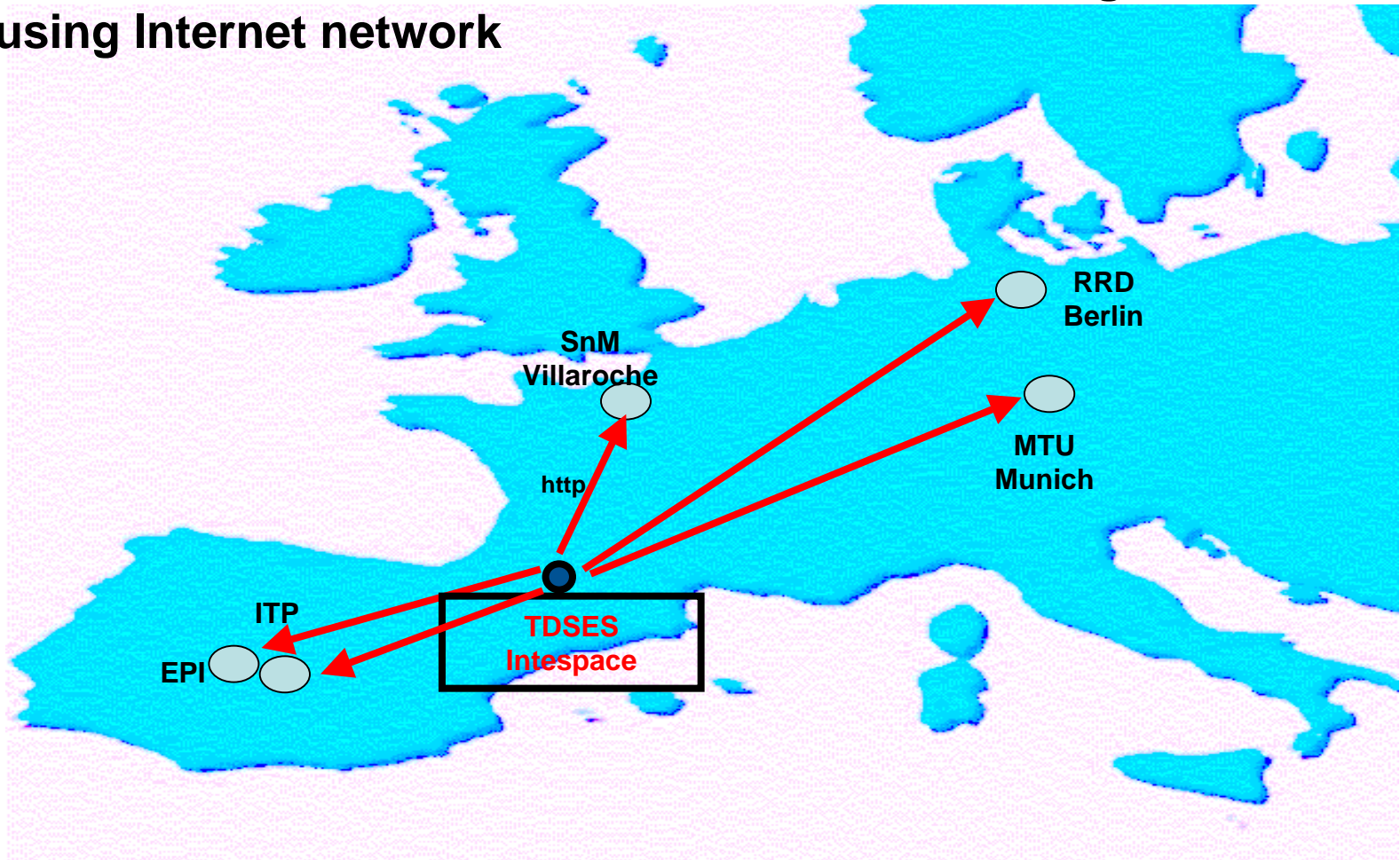
The idea was to build a centralized database which receives measurements in quasi real-time measurement as test progresses...





TP400 analysis

... and to allow access from this database from design teams using Internet network





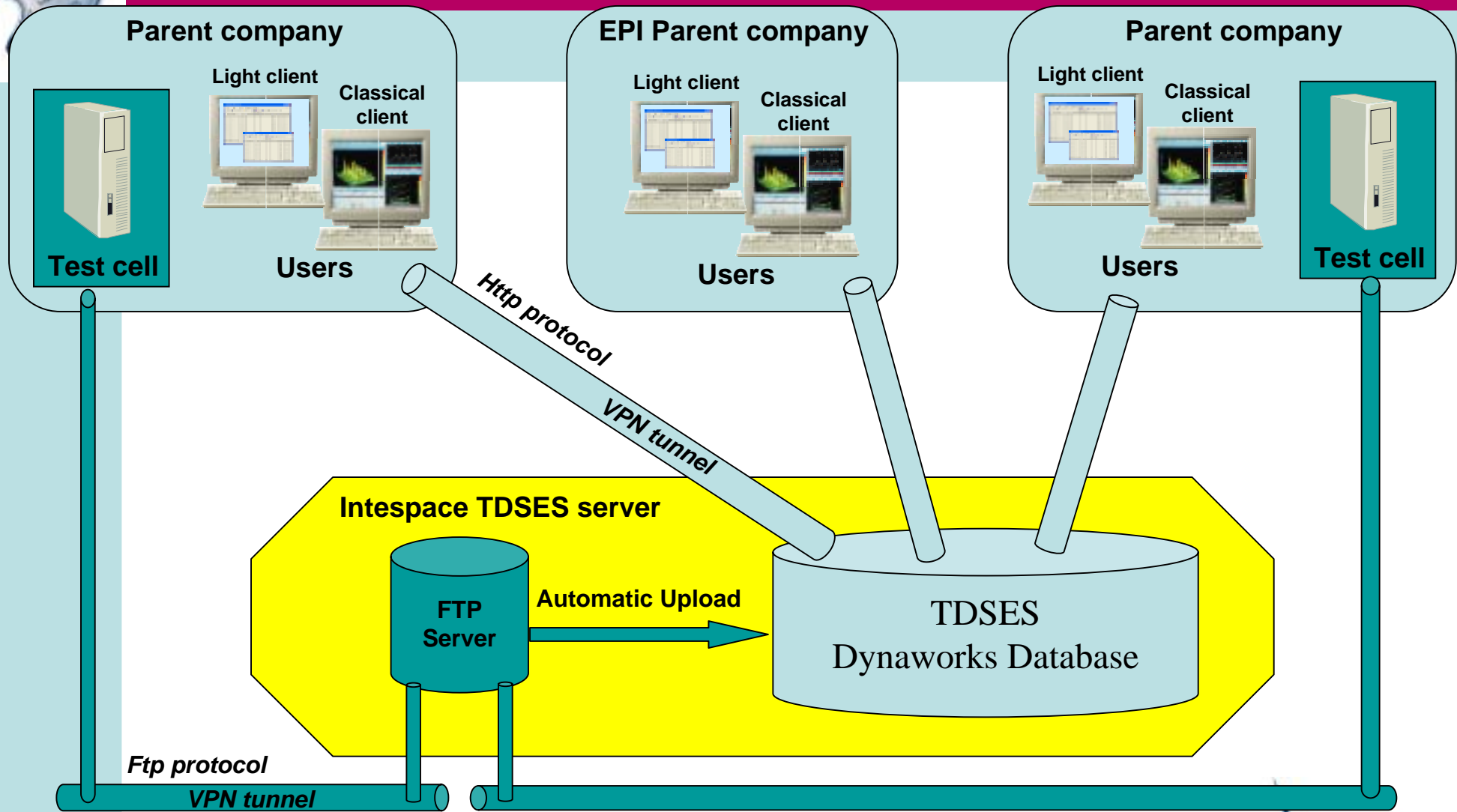
TDSES main features

Type of data available in the database :

- **Steady-state (0 Hz) measurement (Dynamic and static pressure, temperatures, torque, fuel flow, shaft speeds...) when the engine is in a steady state.**
- **Low frequency (100 to 200 Hz) measurement (same kinds) for transient manoeuvre**
- **High frequency (100 kHz) reduced measurement (Accelerometer, Strain gauges...) for dynamic analysis : Campbell diagrams, order tracks...**
- **Images and videos**
- **In the future : acoustic (NB and 1/3 octave spectra)**



TDSES Data flow





TDSES key features

Data inputs :

- Compressed XML files for steady-state and transient data
- Asam-ODS atfx (XML) files for reduced dynamic data
- JPEG, PDF, AVI, MOV... for images and videos

Data storage :

- XML Files are not kept, but are parsed and their content stored in a relational (with object extensions) Dynaworks database
- Each measurement in steady state (0 Hz) result in a record in the database (compressed)
- Each parameter sampled produces a curve (2D or 3D) in the database (compressed)





TDSES key features

Data analysis :

- **By the Dynaworks analysis fat client**
- **With the Dynaworks light client (display only)**
- **With companies legacy tools**

Data output :

- **The user selects a set of measurements and a set of parameters**
- **Database is queried to get the measurement back to the local computer**
- **An XML or Asam file (or Excel...) is written on the local computer with the fetched measurements**





TDSES usage

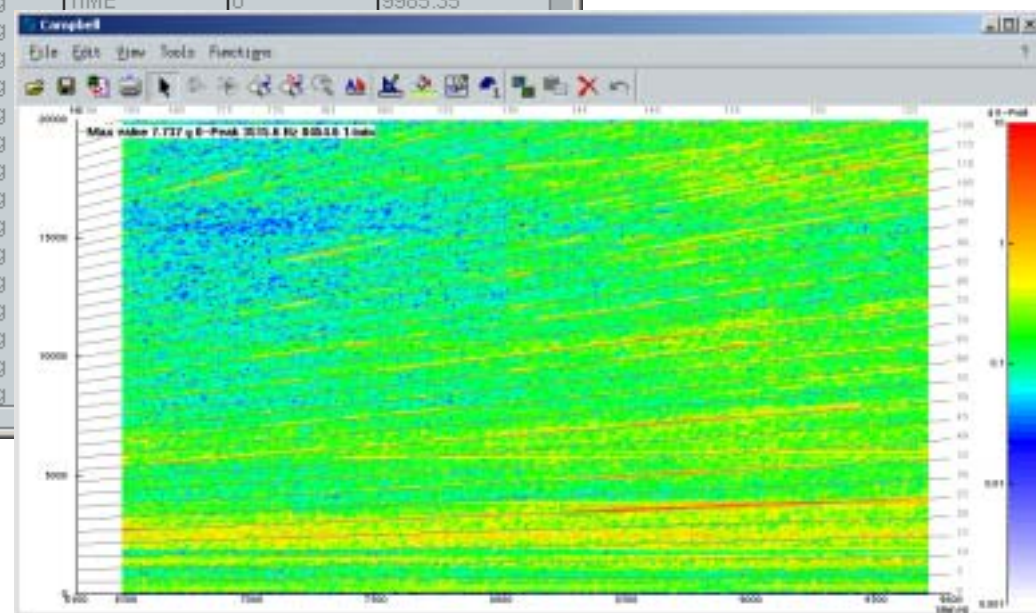
Typical screen shot for Dynaworks users (dynamic data):

TDSES(CampbellDiagram)

File Edit View Functions AeroEngine ?

Number of data: 1554

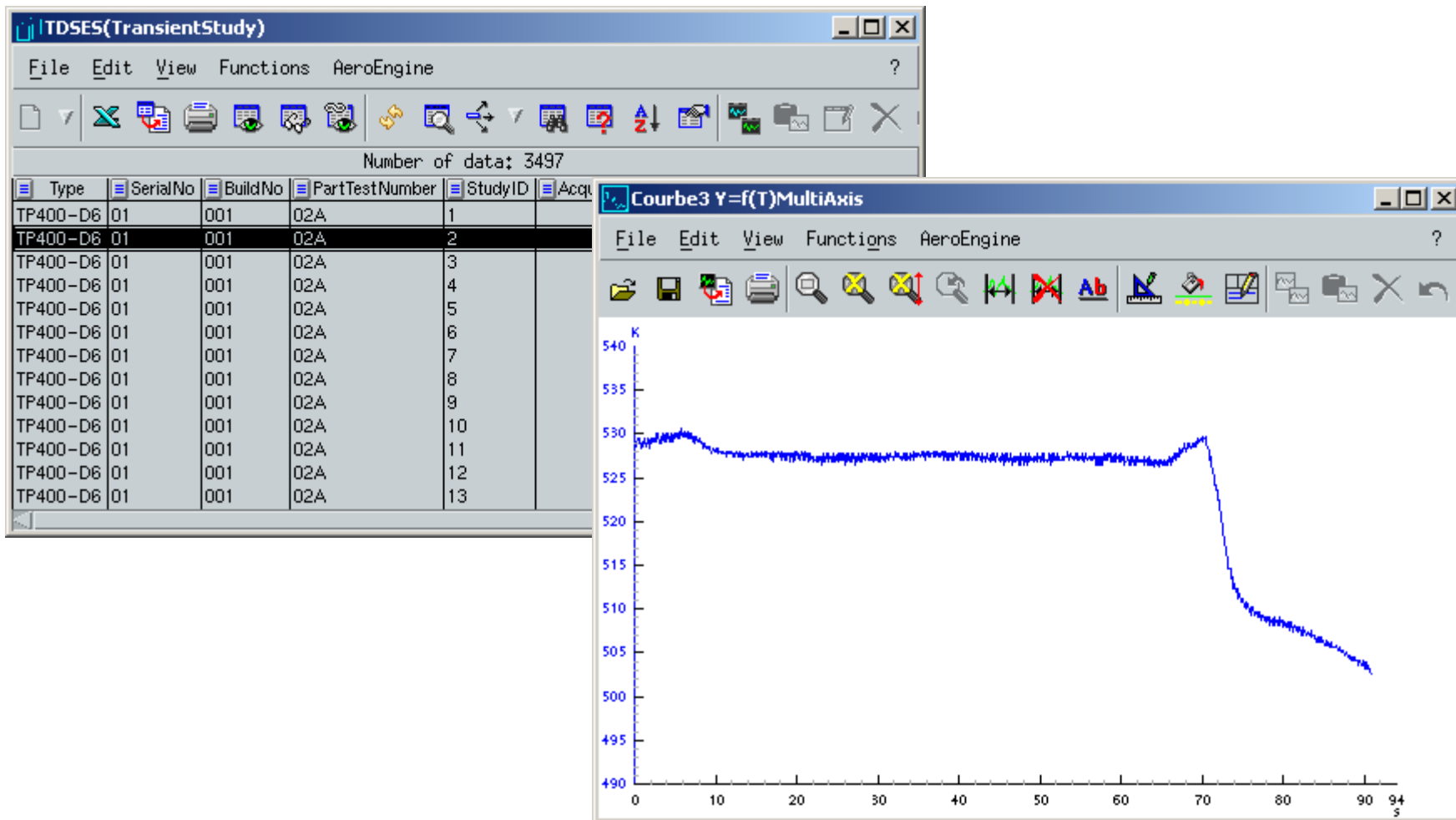
Serial	Build	PartTest	Date	EDPTitle	Manoeuvre	Parameter	Unit	LeadingParam	Fmin(Hz)	Fmax(Hz)
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1145JS	g	TIME	0	9985.35
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1199MH	g	TIME	0	9985.35
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1199SF	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1205KA1	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1205KA2	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A1502AA1	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A4529LX1	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A4529SE1	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A4529SE2	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A6552AV	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A6552EL	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A6552MF	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A7303AA1	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A7303AA2	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A7303AA3	g			
01	001	02B	2006/07/10 00:00	Essai56-0016-001	IRIG 1	A7307PB1	g			





TDSES usage

Typical screen shot for low frequency data :





TDSES security issues

VPN connection between partners

Data on disk can be encrypted with 256 bits AES encryption keys

Strong authentication of incoming users

**Compressed protocol to reduce bandwidth usage and increase
difficulty of decryption**

Protocol compatible with firewalls and proxies

**Possibility to set rules to allow access only to subpart of the data
relevant to the responsibility of the designer**





TDSES performance issues

Internet access, 4 Mbits (must be increased for video)

**Query database, getting a subset of curves in a set of millions
ones, less than 1 second**

Get transfer function and display, less than 1 second

**Bandwidth usage typical is less than 1 kBytes for a typical
transfer function**

**Database mechanism allow to transfer only the small subset of
data needed by each user**

**Local client cache (ie local copy of most recent accessed data)
improves performance and reduces bandwidth usage**

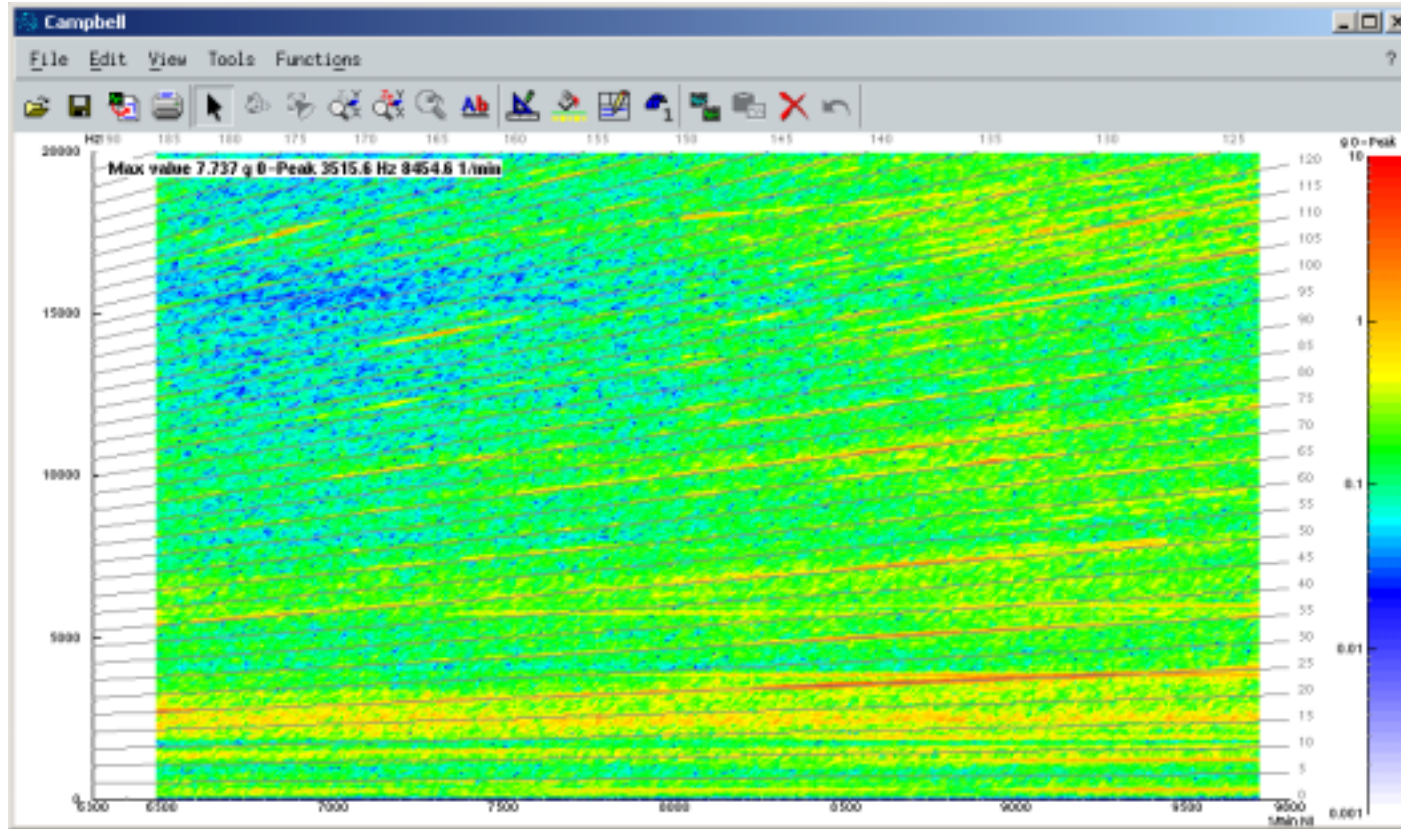




TDSES dynamic data

Design and features for dynamic data

Campbell diagrams stored without threshold, as a time-ordered set of spectra in true engineering units, which can be plotted vs any shaft speed

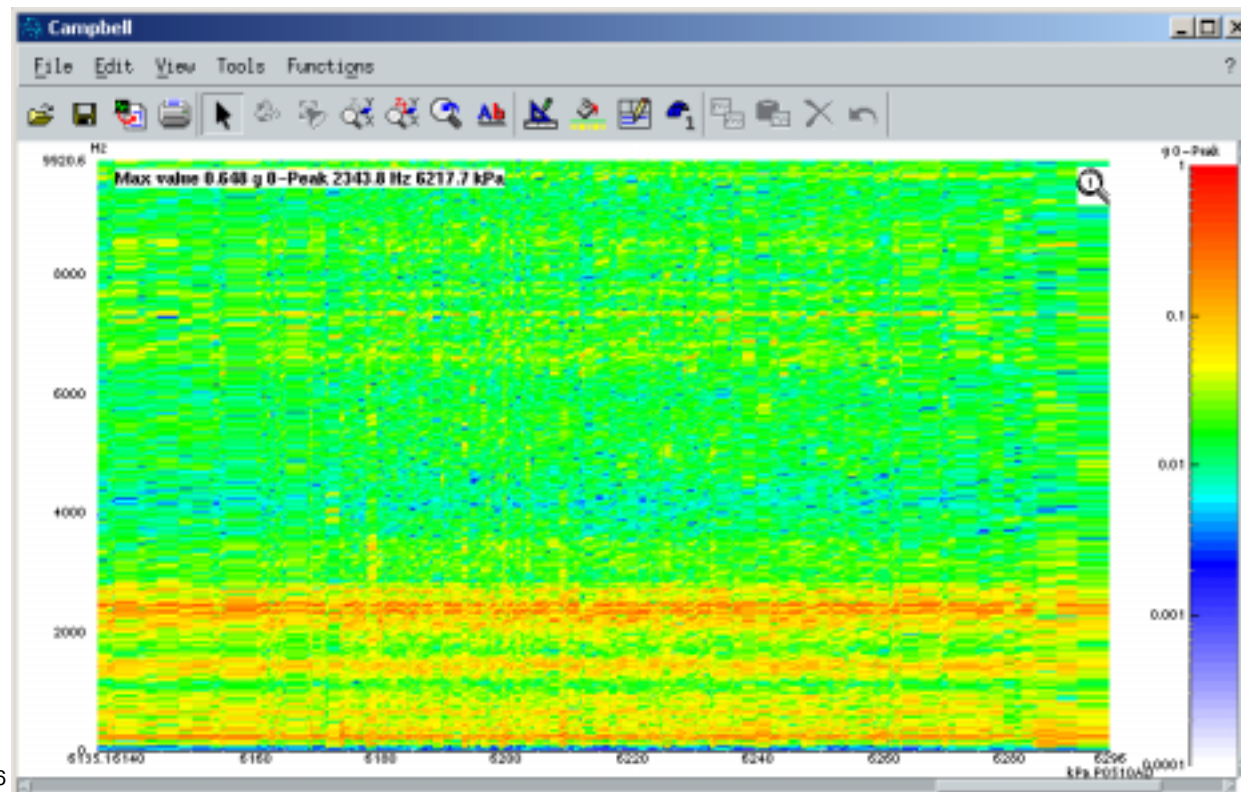




TDSES dynamic data

Design and features for dynamic data

As other parameters such as torque and pressures are also available, Campbell diagrams can also be plotted vs any other parameter : torque, airflow... to allow multi-disciplinary analysis of the engine (vibration induced by aerodynamic phenomena's...)





TDSES

Schedules

TDSES was ready for the first engine to test in October 2005 for steady-state and transient data only

Dynamic data was added during 2006

Videos are in the process of being incorporated in TDSES

Begin of March 2007 figures :

3700 steady state scans

3 600 000 “zero Hz” measurements

3500 transient manoeuvres

650 000 curves

5000 Campbells

14 Gbytes





Conclusions

The usage of a commercial product and the Internet network allows TP400 parent companies to build an efficient, cheap test database system in a very short schedule

I would like to thank also for their help and cooperation :

Mr Trollet from Snecma engine

Mr Fonbonne from Snecma engine

Mr Jean-Louis Eyraud from EPI

Mr Thomas Speer from MTU

Mr Eberhard Ruff from Rolls-Royce

Mr Garcia and Cano from ITP





INTESPACE: a world presence

