

# The European program UFAST (Unsteady eFfects of shock wAve induced SeparaTion)

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## **Objective:**

Coordination at a European level of research on Shock/Boundary Layer Interactions.

Provide a comprehensive experimental data base.

Contribute to the improvement of methods.

## **Type of tool: STREP**

(Specific Targeted REsearch Project)

**Focus** is made on unsteady aspects and on multiscale problems.

## **State of the (experimental) art:**

Many things explored in the US for:

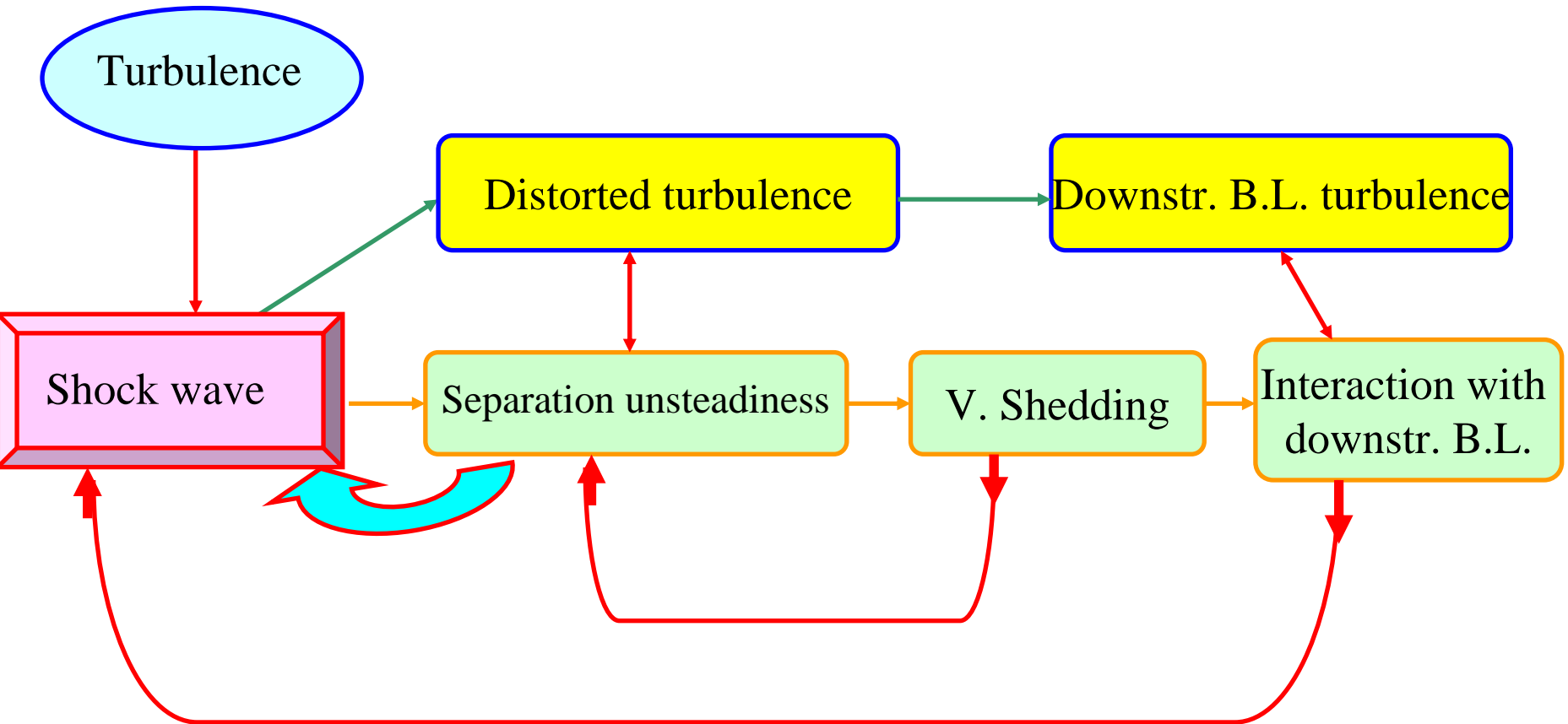
Compression corners

Blunt fins

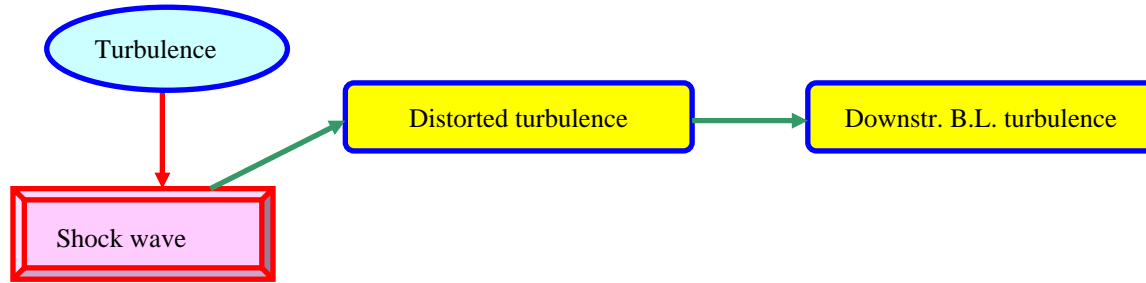
## **Numerically:**

Restricted to URANS, hybrid methods and LES

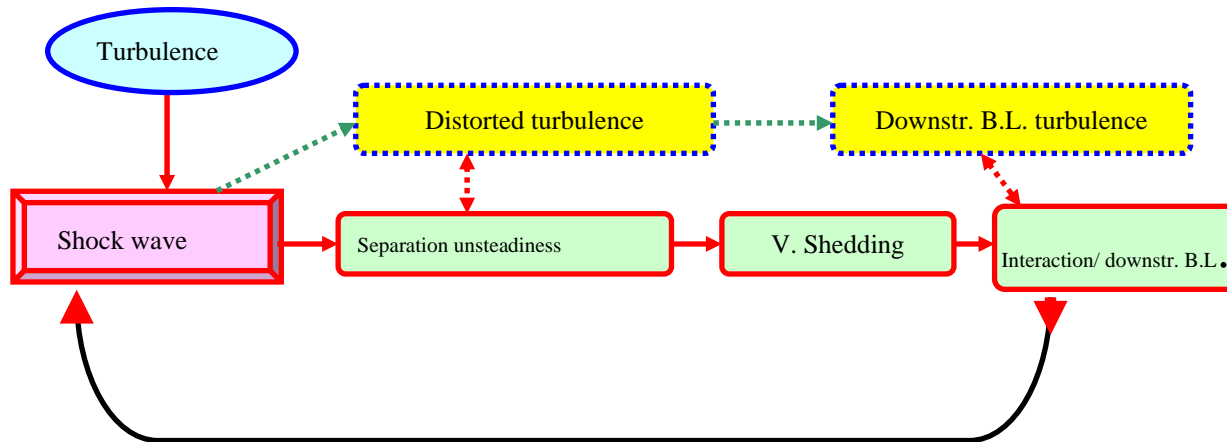
# Introduction



# Classification

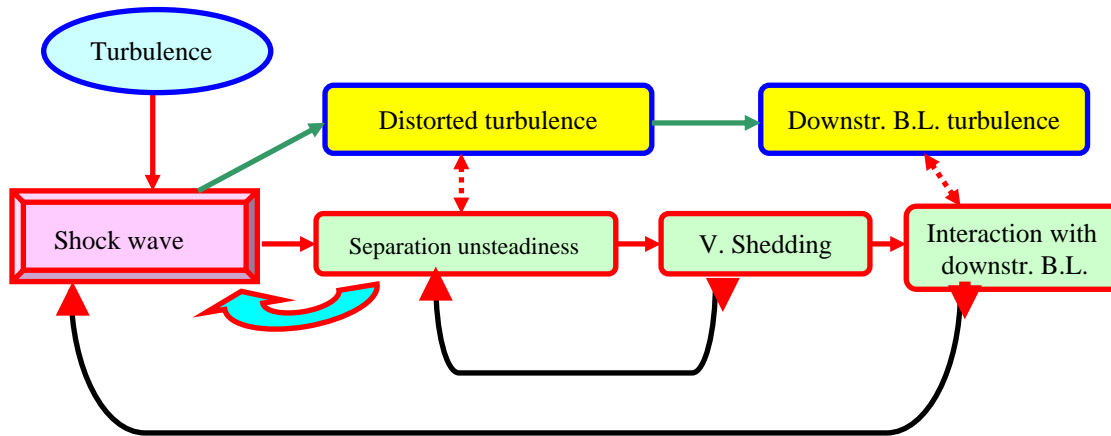


Actions: Rapid Distortion...  
Simple upstream dependence



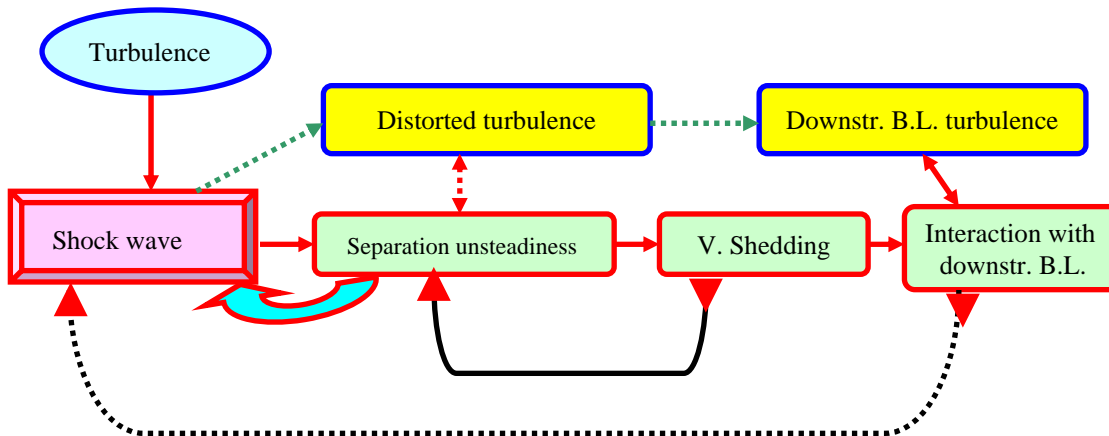
Long range interactions:  
Buffeting....

# Classification



Medium range interaction

Channel flow (plane shock)



Short range interactions:

Supersonic oblique shock flows: compression ramps, shock reflection

# Three types of flows retained:

Transonic interactions on profiles

Plane shock interactions

Oblique shock reflections

# **The consortium is composed of**

20 partners

8 Experimental groups

13 Numerical groups

It is run by P. Doerffer, Gdansk, Poland

### 3. Participant list

#### List of Participants

Partic. Role	Partic. no.	Participant name	Participant short name	Country	Date enter project	Date exit project
CO	1	The Szewalski Institute of Fluid Flow Machinery Polish Academy of Sciences	IMP PAN	Poland	month 1	month 36
CR	2	CNRS Lab. IUSTI, UMR 6595, Marseille	IUSTI	France	month 1	month 36
CR	3	ONERA: (DAFE, DAAP)	ONERA	France	month 1	month 36
CR	4	University of Cambridge, Dept. of Engineering	UCAM-DENG	Great Britain	month 1	month 36
CR	5	Queens University Belfast, School of Aero. Eng.	QUB	Great Britain	month 1	month 36
CR	6	Russian Academy of Science, Siberian Branch, Novosibirsk, Inst. of Theor. App. Mech.	ITAM	Russia	month 1	month 36
CR	7	Delft University of Technology, Aerodyn. Lab.	TUD	Holland	month 1	month 27
CR	8	INCAS, Romanian Institute for Aeronautics	INCAS	Romania	month 1	month 36
CR	9	University of Southampton, (SES)	SOTON	Great Britain	month 1	month 36
CR	10	University of Rome "La Sapienza",	URMLS	Italy	month 1	month 36
CR	11	University of Liverpool, Dept. of Engineering	LIV	Great Britain	month 1	month 36
CR	12	NUMECA, Belgium, SME	NUMECA	Belgium	month 1	month 36
CR	14	Institute Mécanique des Fluides de Toulouse	IMFT	France	month 1	month 36
CR	16	FORTH/IACM, Found. for Res. and Techn.-Hellas	FORTH	Greece	month 1	month 36
CR	17	Ecole Centrale de Lyon	LMFA	France	month 1	month 36
CR	19	EADS-M, Deutschland GmbH Military Aircraft	EADS-M	Germany	month 1	month 36
CR	20	Institute of Aviation, Warsaw	IoA	Poland	month 1	month 36

7.3 Graphical presentation of work packages


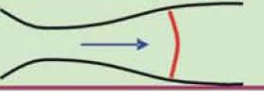

<b>UFAST</b>	<b>Transonic interaction</b>	<b>Channel flow</b>	<b>Shock reflection</b>
<p><b>WP -2</b> Basic experiments  <i>Jean Paul Dussauge</i></p>	 <p><b>1</b> A) QUB – wall bump B) INCAS – biconvex aerofoil C) IoA – NACA0012 with aileron</p>	 <p><b>2</b> A) ONERA (DAFE) –nozzle, forced shock oscillation B) UCAM – nozzle, forced shock oscillation C) IMP – nozzle – curved channel</p>	 <p><b>3</b> A) TUD – M=1.6 B) ITAM – M=2.0 C) IUSTI – M=2.25</p>
<p><b>WP – 3</b> Interaction control experiments  <i>Holger Babinsky</i></p>	<p><b>1</b> 1) QUB – SJ 2) INCAS – SJ 3) IoA – pitching aerofoil and aileron</p>	<p><b>2</b> 1) ONERA – VG, AJVG 2) UCAM – SVG 3) IMP – active suction, 4) IMP – AJVG</p>	<p><b>3</b> 1) ITAM – EHD 2) IUSTI – AJVG</p>
<p><b>WP -4</b> RANS, URANS  <i>Charles Hirsh</i></p>	<p><b>1</b> LIV – A-1 INCAS – B-2 IMFT – A-1, B-2, C-3</p>	<p><b>2</b> LIV – A-1, C-4 FORTH – A-1, B IMP – C-3, C-4 NUMECA - B</p>	<p><b>3</b> URLMS – A NUMECA – C IMFT – C</p>
<p><b>WP -5</b> Hybrid, RANS/LES, LES  <i>George Barakos</i></p>	<p><b>1</b> LIV – A-1 INCAS – B-2 IMFT – A-1, B-2, C-3 LMFA – A-1, B-2, C-3 EADS-M - B</p>	<p><b>2</b> LIV – A-1, C-4 FORTH – A-1, B LMFA – A, B, C NUMECA – B</p>	<p><b>3</b> SOTON – A, B, C NUMECA- C IMFT - C URLMS – A ONERA (DAAP) – C-2</p>

Fig.7.3.1 Presentation of the project research activities

## Detailed objectives

Experimentally, to provide a data base with unsteadiness measurements: mainly spectra, and most probably of wall pressure fluctuations.

Some conditional measurements are considered (shock with periodic excitation)

Some 3-d aspects will be explored

Control with synthetic jets or Air jet vortex generators will be considered

Numerically, when possible, exchanges of grids will be organized

The project duration will be of three years.

The results will be published, and elements of the data base will be accessible to external teams at the end of the project.