THER-CFD :

a THERMICA/GAMBIT Gateway

F. BOURSIER

CONTENTS

EADS SPACE TRANSPORTATION

PURPOSE

THER-CFD is a Fortran/Unix Software developed by EADS SPACE Transportation in the frame of the Launch Thermal Analyses

The aim is to build quickly a geometry usable with GAMBIT meshing software based on a geometry available in THERMICA format

EADS SPACE TRANSPORTATION

LAUNCH THERMAL ANALYSIS

OBJECTIVES :

to predict the thermal behaviour of the payload during ground and flight phases

☞ To check the thermal compatibility of the spacecraft with the launch vehicle

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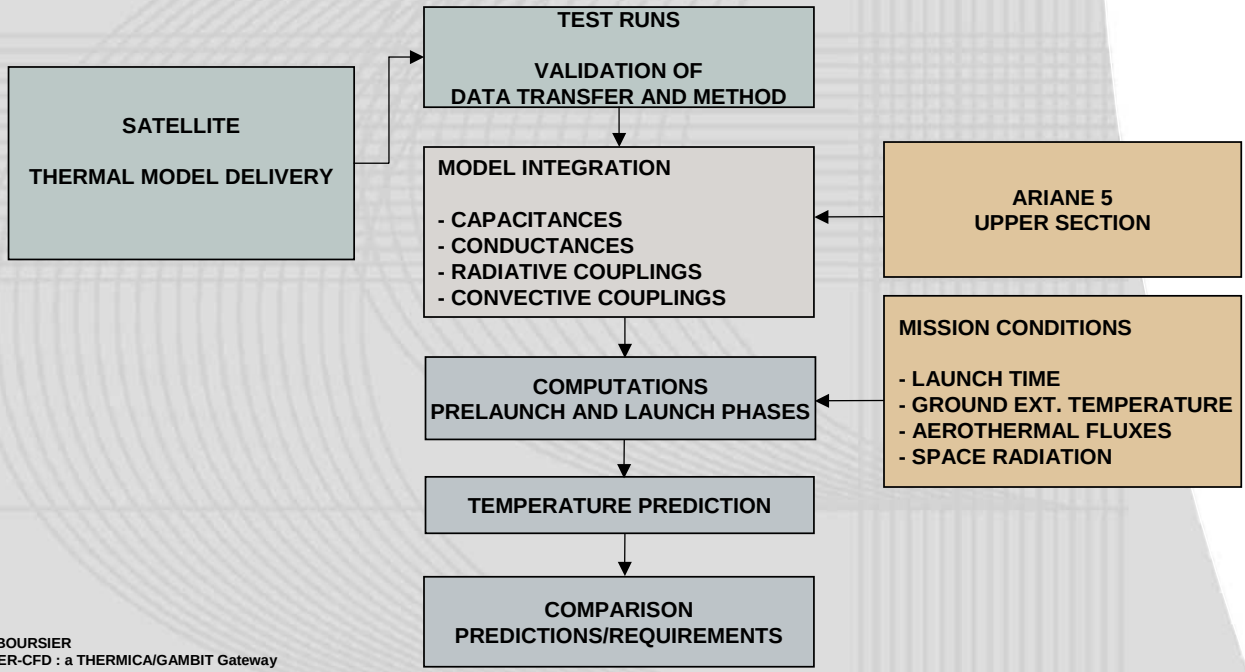
THERMAL ANALYSIS FLOW



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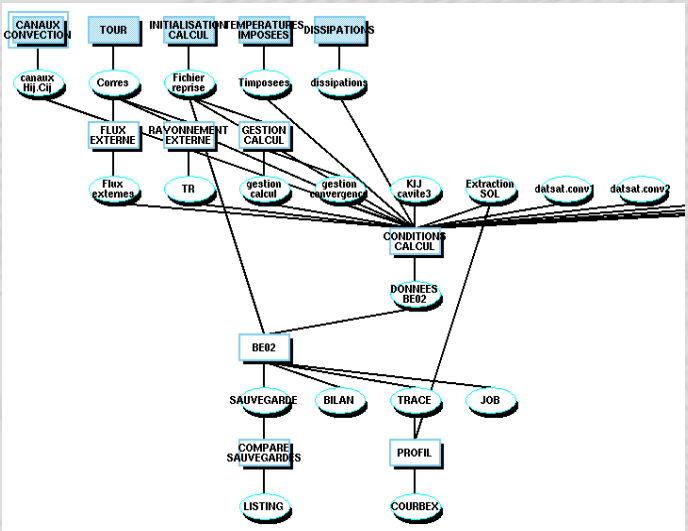
SOFTWARES

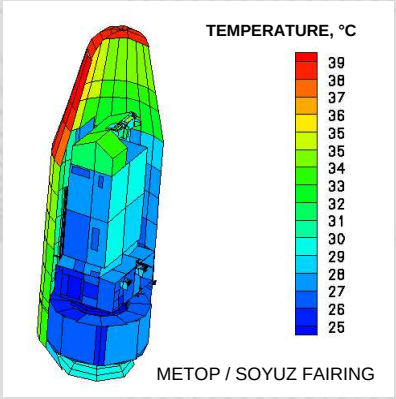


AUTOMATIC CALCULATION CHAIN : **LOGIAT**

(about 150 elementary tasks)

TEMPERATURE SOLVER : **SISTHER**

(Nodal representation)



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SOFTWARES

AIR FLOW CALCULATION : **GAMBIT / FLUENT**

- to refine convective coefficients determination
- to check that air velocity stays below maximal allowed levels

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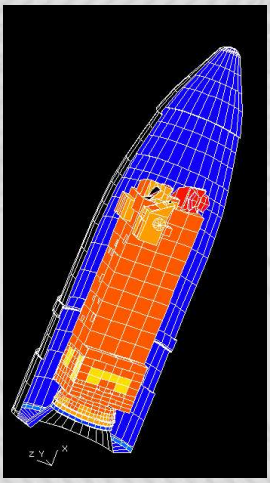
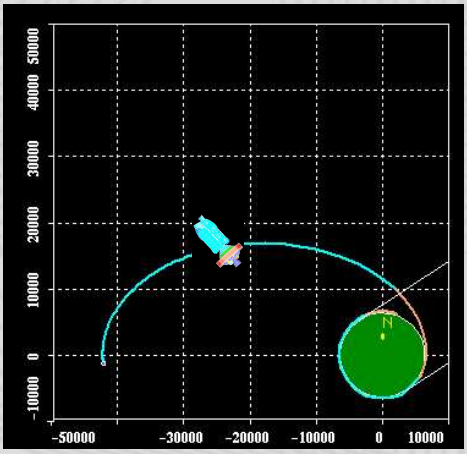
SOFTWARES

RADIATION : **THERMICA**



Radiative couplings inside a closed cavity



External heat fluxes during flight

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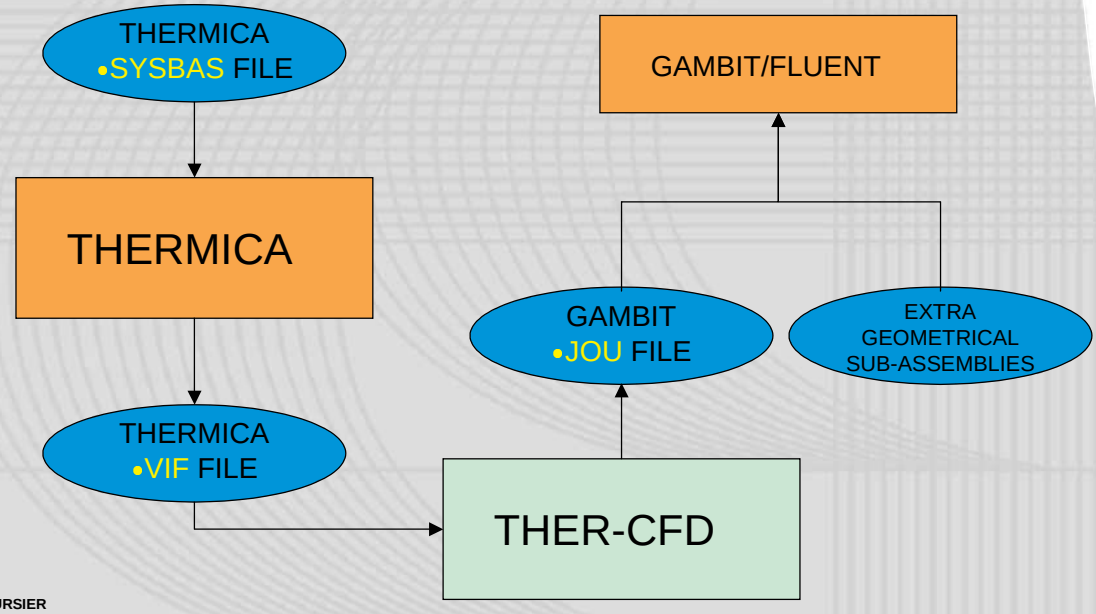
From THERMICA to GAMBIT



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From THERMICA to GAMBIT

```
<1,1,2,1> DISQUE EPAISSEUR PROTECTION AC - 26001
     4 26001     0     1     4    -1.000000          -1
   .00000E+00   .00000E+00   .56470E+01   .00000E+00   .00000E+00   .57470E+01
   .70711E+00  -.70711E+00   .56470E+01   .00000E+00   .00000E+00   .00000E+00
   .52140E+01   .51940E+01   .00000E+00   .00000E+00   .00000E+00   .36000E+03
   .10000E+01   .00000E+00   .00000E+00   .00000E+00   .10000E+01   .00000E+00
.00000E+00   .00000E+00
```

THERMICA .VIF FILE

```
    vertex create « p1 » coordinates 0 0 .56470E+01
    vertex create « p2 » coordinates 0 0 .57470E+01
    vertex create « p3 » coordinates .70711E+00 -.70711E+00 .56470E+01
    coordinate create cartesian vertices « p1 » « p2 » « p3 »
    vertex copy « p1 » to « vertex.4 »
    vertex move « vertex.4 » offset 2.607 0 0
    vertex copy « p1 » to « vertex.5 »
    vertex move « vertex.5 » offset 0 2.607  0
    edge create « cerc1 » center2points « p1 » « vertex.4 » « vertex.5 »
circle
    face create « disque1 » wireframe « cerc1 » real
    vertex copy « p1 » to « vertex.6 »
    vertex move « vertex.6 » offset 0 2597 0
    vertex copy « p1 » to « vertex.7 »
    vertex move « vertex.7 » offset 2.597 0 0
    edge create « cerc2 » center2points « p1 » « vertex.7 » « vertex.6 »
circle
    face create « disque2 » wireframe « cerc2 » real
```

GAMBIT .JOU FILE

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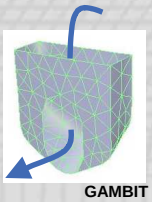
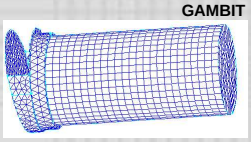
From THERMICA to GAMBIT

EXTRA GEOMETRIES ADDED WITH GAMBIT



GAMBIT



GAMBIT

Acoustic protection

Venting hole

Air inlet deflector

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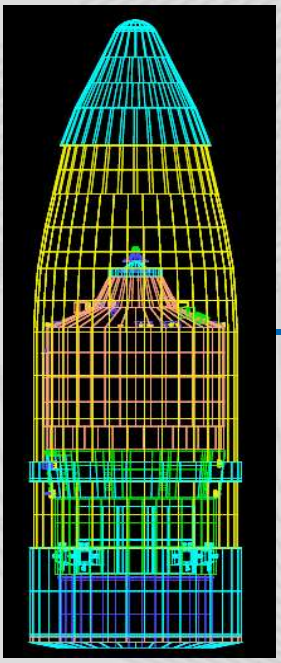
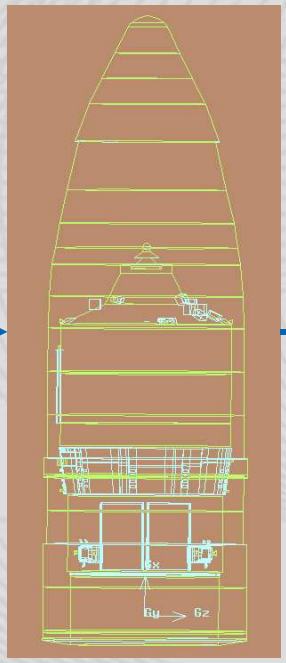
From THERMICA to GAMBIT

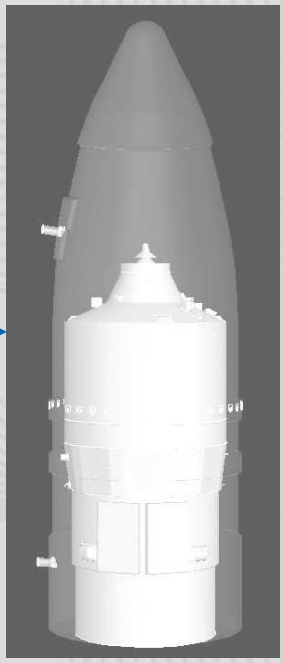
THERMICA



GAMBIT



FLUENT



ATV ARIANE 5.mpeg

EADS SPACE TRANSPORTATION

CONCLUSION

THER-CFD ALLOWS A TRANSITION FROM THERMICA TO GAMBIT WHICH LEADS :

- To use a more acurate geometrical definition of the domains considered
- To lower the cost of CFD calculations thanks to shorter processes