

SCORE

SUSTAINABLE **C**OMPARISON AND **O**PTIMIZATION OF
MATERIAL AND **M**ANUFACTURING PROCESS FOR
RESPONSIBLE **E**NGINEERING

CNES ECO-DESIGN TOOL

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CLEANSPACE DAYS 2026
2026-06-30

AGENDA

- **01** INTRODUCTION : ECO-DESIGN AT CNES
- **02** SCORE ECO-DESIGN TOOL SPECIFICATION AND DESCRIPTION
- **03** APPLICATION TO A REAL-WORLD SCENARIO
- **04** CONCLUSION

INTRODUCTION : ECO-DESIGN AT CNES

A lot of initiatives at all levels (from directions to employees) to develop eco-design at CNES

At the very beginning on orbital system, low resources and budget



French space industry's decarbonization roadmap

managed by DDD and COSPACE

Roadmap on eco-design

managed by DDD

Digital sobriety strategy

with a strong eco-design component
project led by digital department



Eco-design network

with member from all CNES directions

COMET on eco-design

Foreseen workshop on LCA at autumn
(community of experts with people from all spatial ecosystem and even more)

AEREs initiative

To motivate every employee to consider
environmental constraints in his job
communication relay : top/down and down/top



Simplified LCA

on sub-system, technical means, system

Eco-design Tools

in development or evaluation
(ex. : OASIS for project evaluation)



SCORE

TOOL SPECIFICATIONS

Easily integrates into a mechanical design workflow

- ❑ **Easy to use** : excel file,
- ❑ **Not time-consuming**: limited amount of input datas,
- ❑ Takes into account the **most common materials and manufacturing processes**,
- ❑ **Easy to understand results**: comparative results based on single score and on the 16 midpoint indicators,
- ❑ Ability to **save results**: pdf export button.



Sustainable Comparison and Optimization of materials and manufacturing processes for Reduced-impact Engineering

TOOL DESCRIPTION

7 tabs

A1 – Tool guide

Tool description and objectives, terms of use and list of tabs.

A2 – User guide

List and description of the steps to follow to use the tool.

A3 – Results guide

Information on environmental impact assessments to help you understand the results.

B – Input data

Input data and project description tab.

C1 – Comparative results

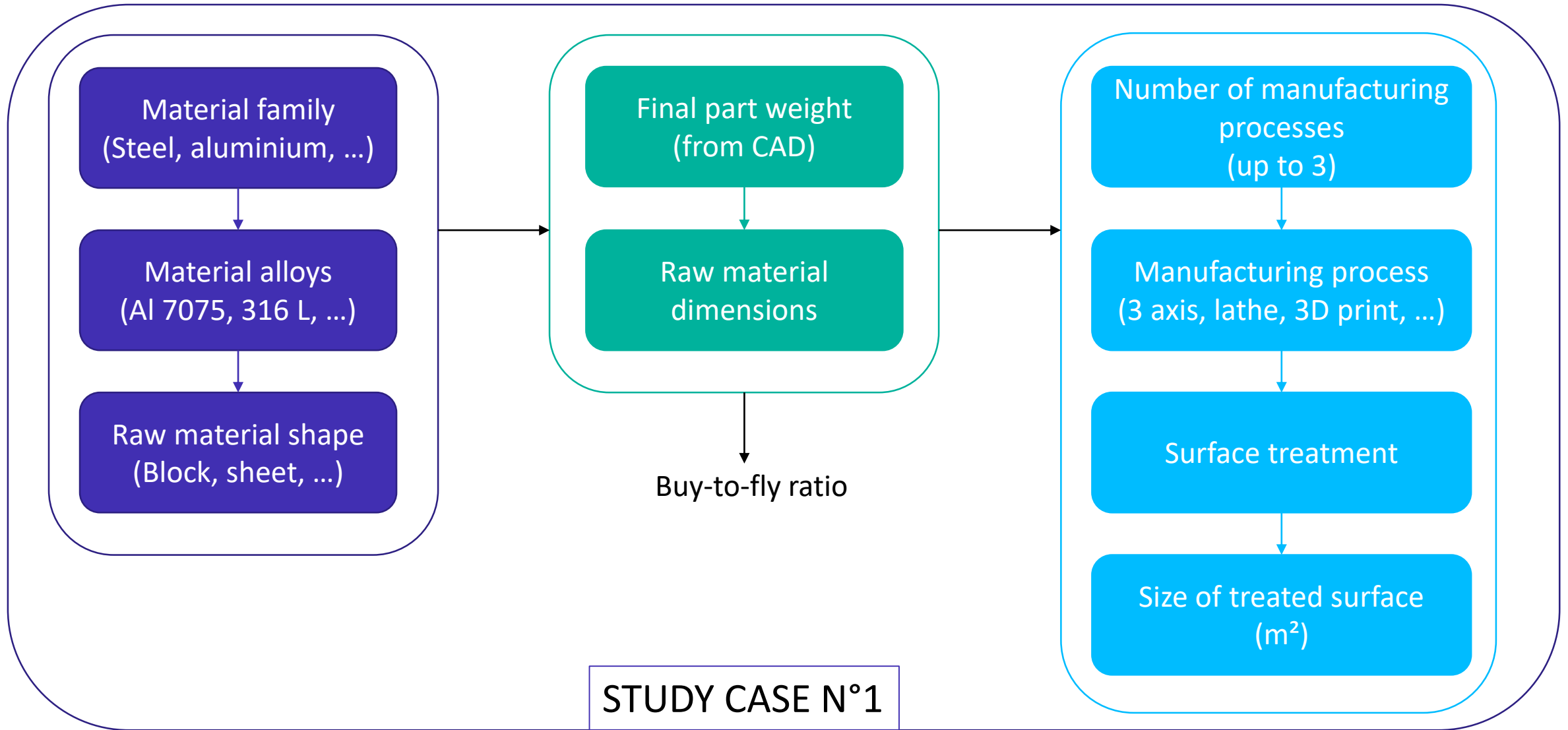
Comparative results of different solutions based on single score.

C2 – Detailed results

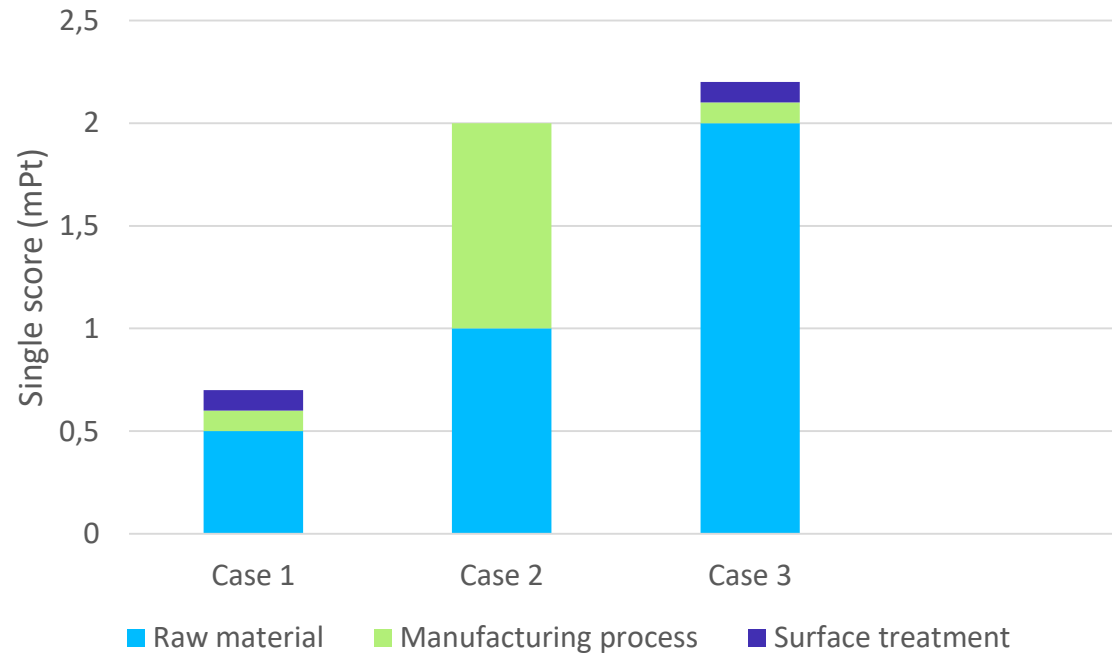
Detailed results of different solutions based on 16 midpoint indicators.

D – Materials & processes list

List of all available materials and manufacturing processes .



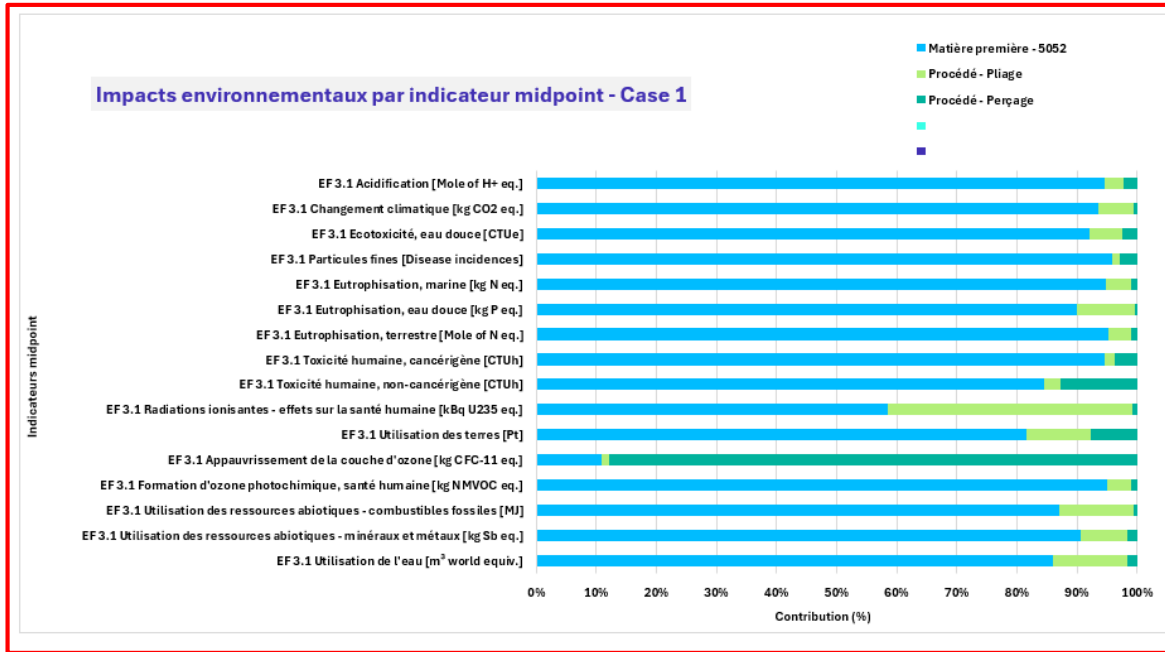
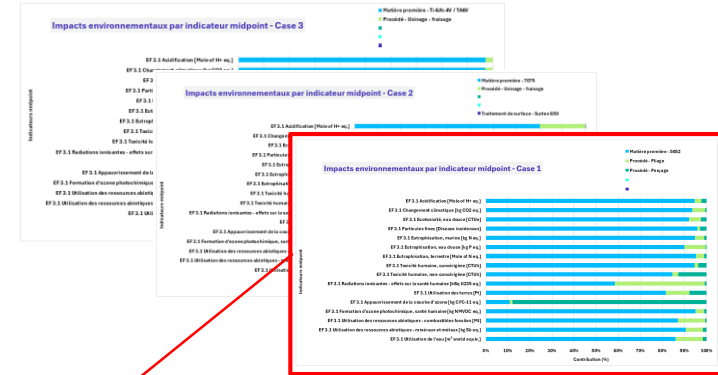
Total single score comparison



Case ranking from least to most impactful	Total single score
Case 1	0,7 mPt
Case 2	2 mPt
Case 3	2,2 mPt

And a few other ways to display results:

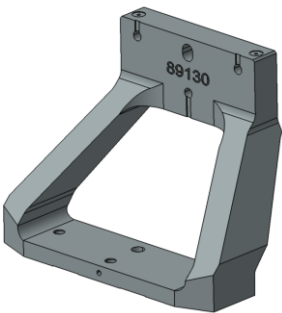
- Table of detailed single score for each cases,
- Table showing the most and least impactful elements (material, process, treatment) by cases.



Shows the contribution of raw materials, manufacturing processes and surface treatments to each of the 16 midpoint indicators and for each study cases.

APPLICATION TO A REAL-WORLD SCENARIO

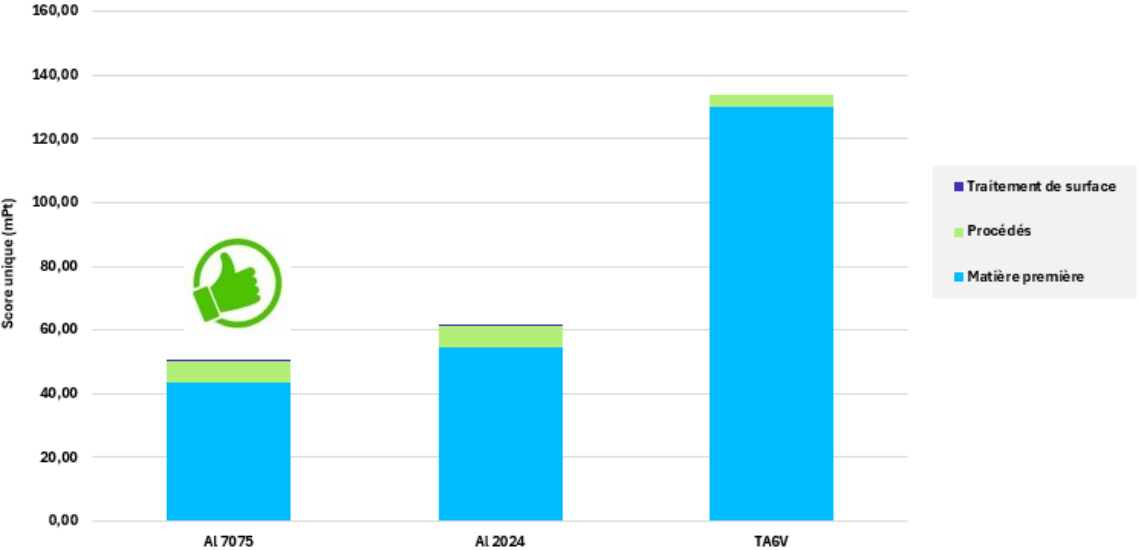
« I just need to compare different materials »



Hypotheses:

- Design can't change,
- Ground equipment,
- No specific requirements for materials,
- If aluminium alloy: surface treatment (surtec 650),
- Manufacturing process: 3 axis machining.

Comparaison des scores uniques totaux



Al 7075

OK

Données de base	
Famille	Aluminium
Matériau	7075
Forme du brut	Bloc
Masse pièce finale (kg)	2,507
Longueur du brut (m)	0,25
Largeur du brut (m)	0,25
Epaisseur du brut (m)	0,1
Diamètre du brut (m)	
Buy-to-fly = 7,005	

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Surtec 650
Surface traitée (m2)	

Note: le Surtec est en kg de pièce traitée, donc pas besoin de rentrer la surface

Al 2024

OK

Données de base	
Famille	Aluminium
Matériau	2024
Forme du brut	Bloc
Masse pièce finale (kg)	2,481
Longueur du brut (m)	0,25
Largeur du brut (m)	0,25
Epaisseur du brut (m)	0,1
Diamètre du brut (m)	
Buy-to-fly = 7,003	

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Surtec 650
Surface traitée (m2)	

Note: le Surtec est en kg de pièce traitée, donc pas besoin de rentrer la surface

TA6V

OK

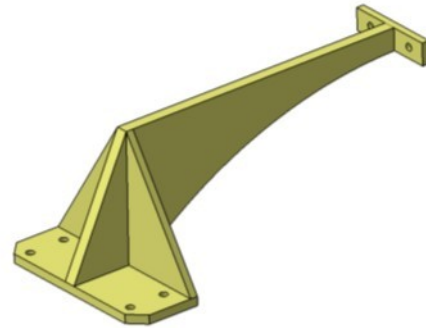
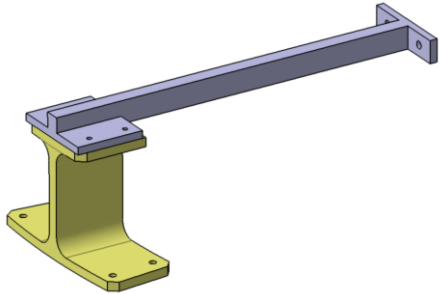
Données de base	
Famille	Titane
Matériau	Ti-6Al-4V / TA6V
Forme du brut	Bloc
Masse pièce finale (kg)	4,024
Longueur du brut (m)	0,25
Largeur du brut (m)	0,25
Epaisseur du brut (m)	0,1
Diamètre du brut (m)	
Buy-to-fly = 6,881	

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Aucun
Surface traitée (m2)	

Classement des options de la moins impactante à la plus impactante	Score total
Al 7075	50,34 mPt
Al 2024	61,43 mPt
TA6V	134,07 mPt

APPLICATION TO A REAL-WORLD SCENARIO

« I want to compare 2 different designs: one is a single part, the other is a 2 parts assembly »



Hypotheses:

- Material: Al 7075,
- Surface treatment :surtec 650,
- Manufacturing process: 3 axis machining.
- Not considering screws.

Single part solution

OK

Données de base

Famille	Aluminium
Matériau	7075
Forme du brut	Bloc

Masse pièce finale (kg)	0,4
Longueur du brut (m)	0,263
Largeur du brut (m)	0,122
Epaisseur du brut (m)	0,095
Diamètre du brut (m)	

Buy-to-fly = 21,413

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Surtec 650
Surface traitée (m2)	

Note: le Surtec est en kg de pièce traitée, donc pas besoin de rentrer la surface

2 parts solution (1)

OK

Données de base

Famille	Aluminium
Matériau	7075
Forme du brut	Bloc

Masse pièce finale (kg)	0,214
Longueur du brut (m)	0,078
Largeur du brut (m)	0,12
Epaisseur du brut (m)	0,049
Diamètre du brut (m)	

Buy-to-fly = 6,022

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Surtec 650
Surface traitée (m2)	

Note: le Surtec est en kg de pièce traitée, donc pas besoin de rentrer la surface

2 parts solution (2)

OK

Données de base

Famille	Aluminium
Matériau	7075
Forme du brut	Bloc

Masse pièce finale (kg)	0,145
Longueur du brut (m)	0,25
Largeur du brut (m)	0,06
Epaisseur du brut (m)	0,018
Diamètre du brut (m)	

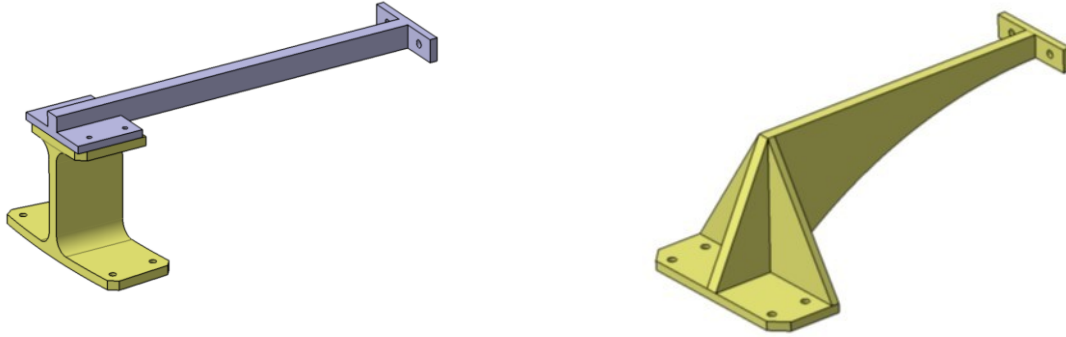
Buy-to-fly = 5,232

Nombre de procédés	1
Procédé 1	Usinage - fraisage
Procédé 2	
Procédé 3	
Traitement de surface	Surtec 650
Surface traitée (m2)	

Note: le Surtec est en kg de pièce traitée, donc pas besoin de rentrer la surface

APPLICATION TO A REAL-WORLD SCENARIO

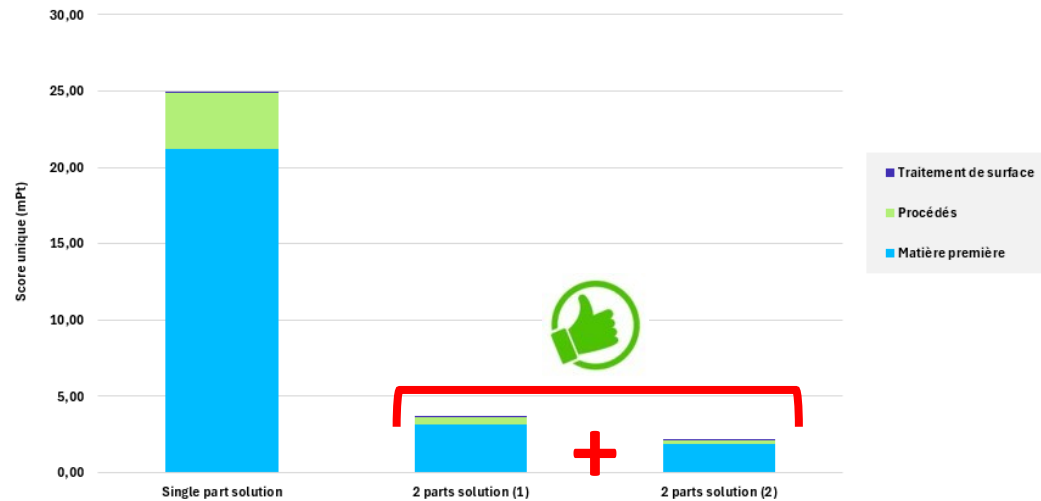
« I want to compare 2 different designs: one is a single part, the other is a 2 parts assembly »



Hypotheses:

- Material: Al 7075,
- Surface treatment :surtec 650,
- Manufacturing process: 3 axis machining.
- Not considering screws.

Comparaison des scores uniques totaux



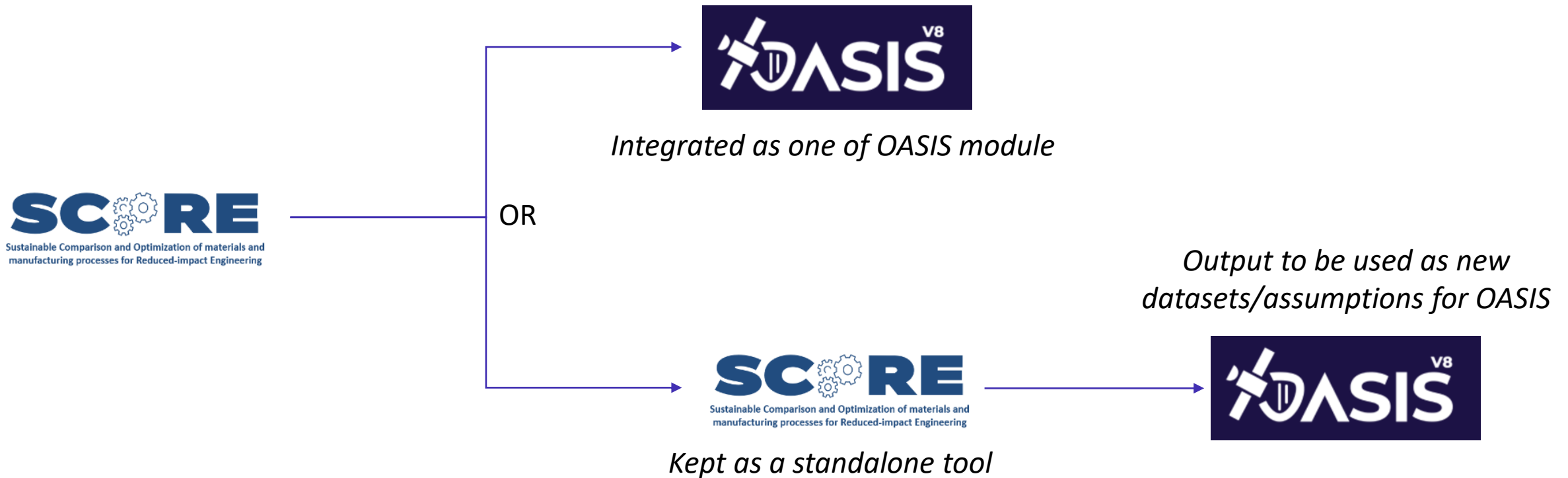
Classement des options de la moins impactante à la plus impactante	Score total
2 parts solution (2)	2,16 mPt
2 parts solution (1)	3,68 mPt
Single part solution	24,86 mPt



2 parts solution (1) + 2 parts solution (2) < Single part solution

WHAT'S NEXT ?

- ❑ Internal use and feedbacks capitalization for few months,
- ❑ Find funding for the next steps: improvements regarding feedbacks,
- ❑ Keep talking about it around us and share our progress,
- ❑ Define tool strategy to ensure it remains aligned with CNES eco-design global strategy:



ANY QUESTIONS?

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Thank you for your attention !