



Local Hawk MBSE Testbed project

A fruitful collaboration between industrial and academic worlds



KONGSBERG

Torfinn.TOBIASSEN@kongsberg.com
Thierry.AMBROISINE@3ds.com
Magnus.FALKMAN@technia.com



Agenda

- Introduction
- Systems Engineering Process improvement
- Model Based Systems Engineering project
- KDS Design & Development process
- Students in Action: Mapping the process onto the tools platform
- Session Takeaways

Kongsberg Defence and aerospace Missile Division



Academic relationship :
- Buskerud University
College (HiBu)
- Norwegian Centre of
Expertise (NCE)

Dassault Systèmes and TECHNIA



a Scientific
company
Serving Science,
Technology and Art
for a sustainable society



Strategic Partner
Leading supplier in the
Nordic area of Product
Lifecycle Management
(PLM) Solutions

To enable our
clients to create
delightful experiences
for their ultimate
customers or consumers



3DEXPERIENCE

A **business platform**
on premise,
on-line,
in public or
private cloud

SE process improvement

Traditional Document driven PDM



The problem:
Too coarse granularity of the design information.

Difficult to manage the structure and relations between design elements.

A finer (less coarse) framework is needed to promote

- Communication, discussions, & analysis of the system and its solution.
- a repository for model artifacts and their relations!

Model based Systems Engineering

Managing

- **Model structure**
- **Model elements / artifacts**
- **Relations to a finer granularity**

Very soon, a tool is needed!

Background

Model Based Systems Engineering project

1. The Missil Division needs process improvement

- The Missile Division admits struggling with system project work for many years.
- We have not been able to agree on common SE methods
- Ongoing projects are suffering from this lack of understanding.



2. Annual recruiting project of master students

Local Hawk
Unmanned Aerial Vehicle



MBSE Project



Local Hawk - The recruiting project

Used as a testcase and Demo project for

Model Based Systems Engineering in The Missile Division

Tools

3D Experience Platform for Systems Engineering ENOVIA, CATIA (RFLP)



Iterate the system function into a functional hierarchy, depositing the results in the RFLP Module

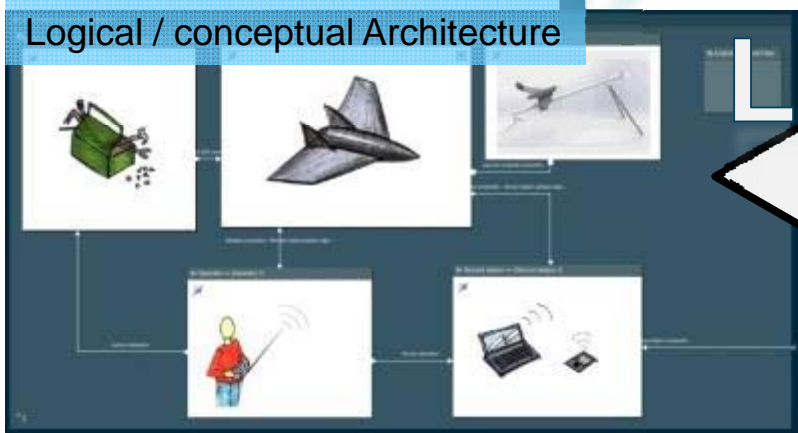


R Feasible!
Key Requirements

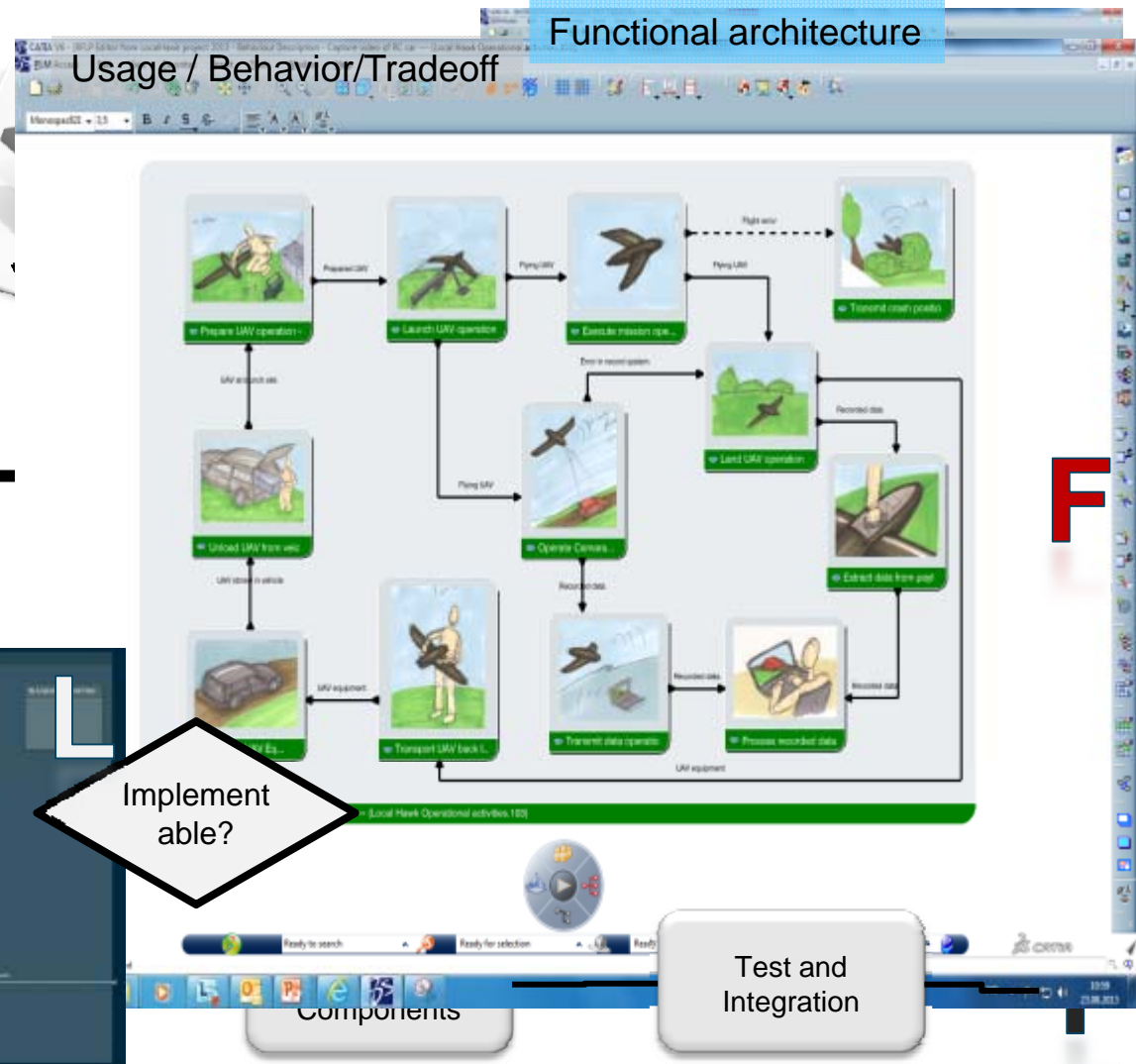
F A function is needed

R

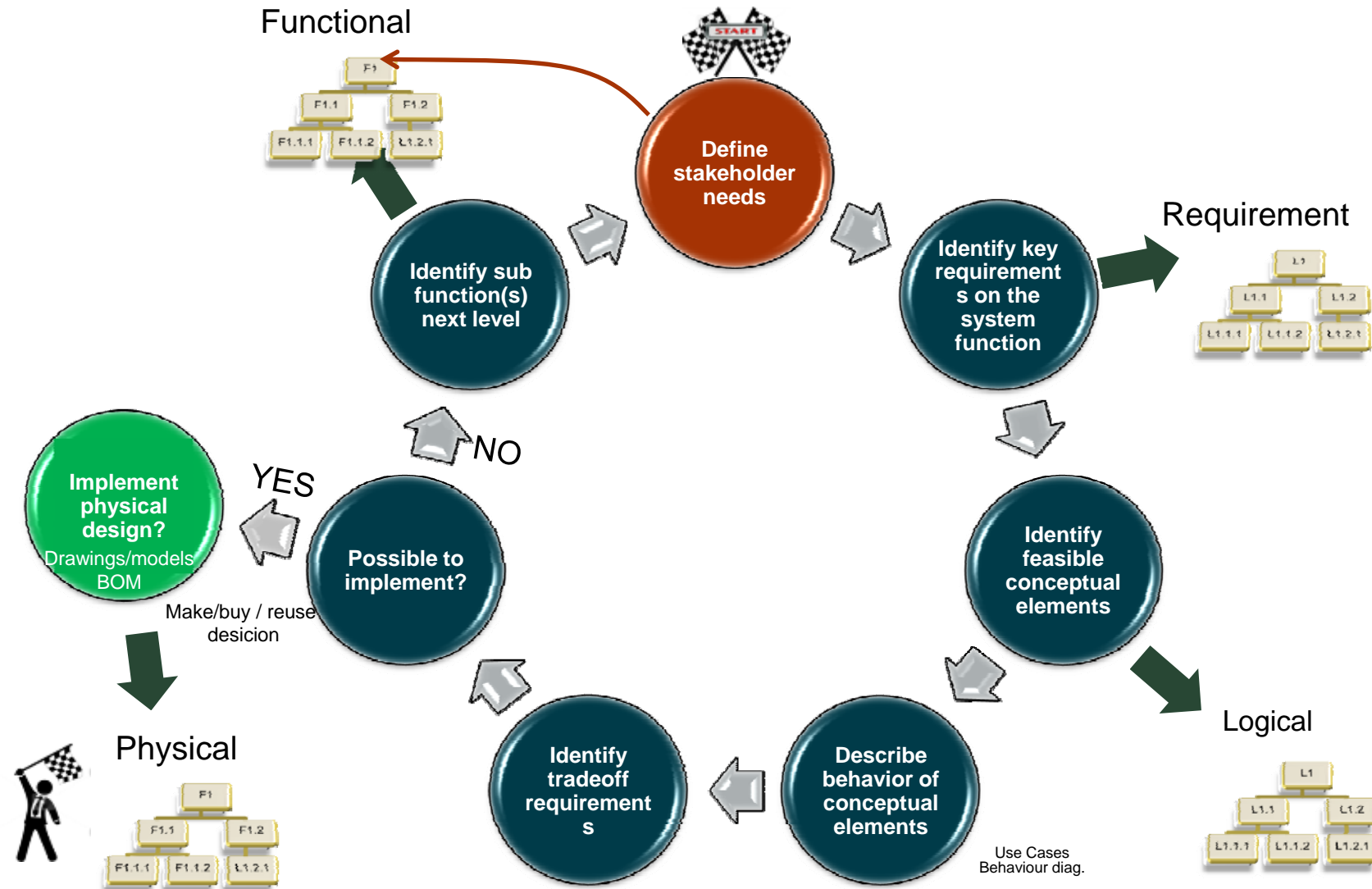
Logical / conceptual Architecture



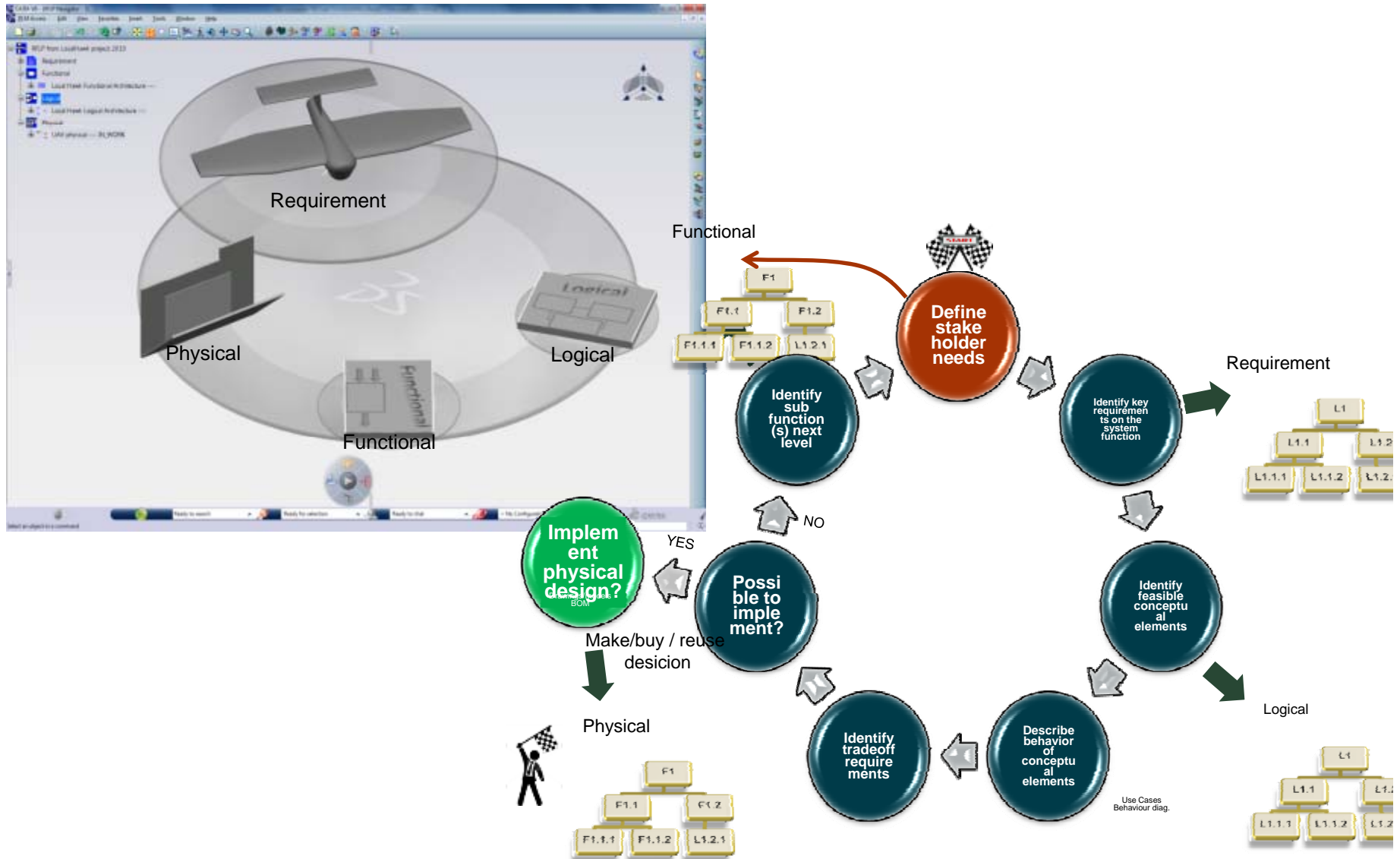
Implement able?



KDS Design & Development process



Mapping the process onto the tool



Identify stakeholder needs



Title: Scenario - STORYBOARD #2 Project: Local Hawk Author: Gudrun Strand Date: 8/2-13

Panel 1: IN KONGSBERG THE ANNUAL RALLY TAKES PLACE - THE LOCAL FAVORITE IN THE RED CAR.

Panel 2: THE RED CAR TAKES THE LEAD OUT IN THE TERRAIN, FAR FROM THE STADIUM.

Panel 3: THE SPECTATORS AT THE STADIUM CAN WATCH EVERY TURN HE TAKES.

Panel 4: BUT THEN, THE DRIVER IS ON HIS WAY OUT OF THE ROAD!

Panel 5: THE DRIVER GET'S BACK ON TRACK AGAIN...

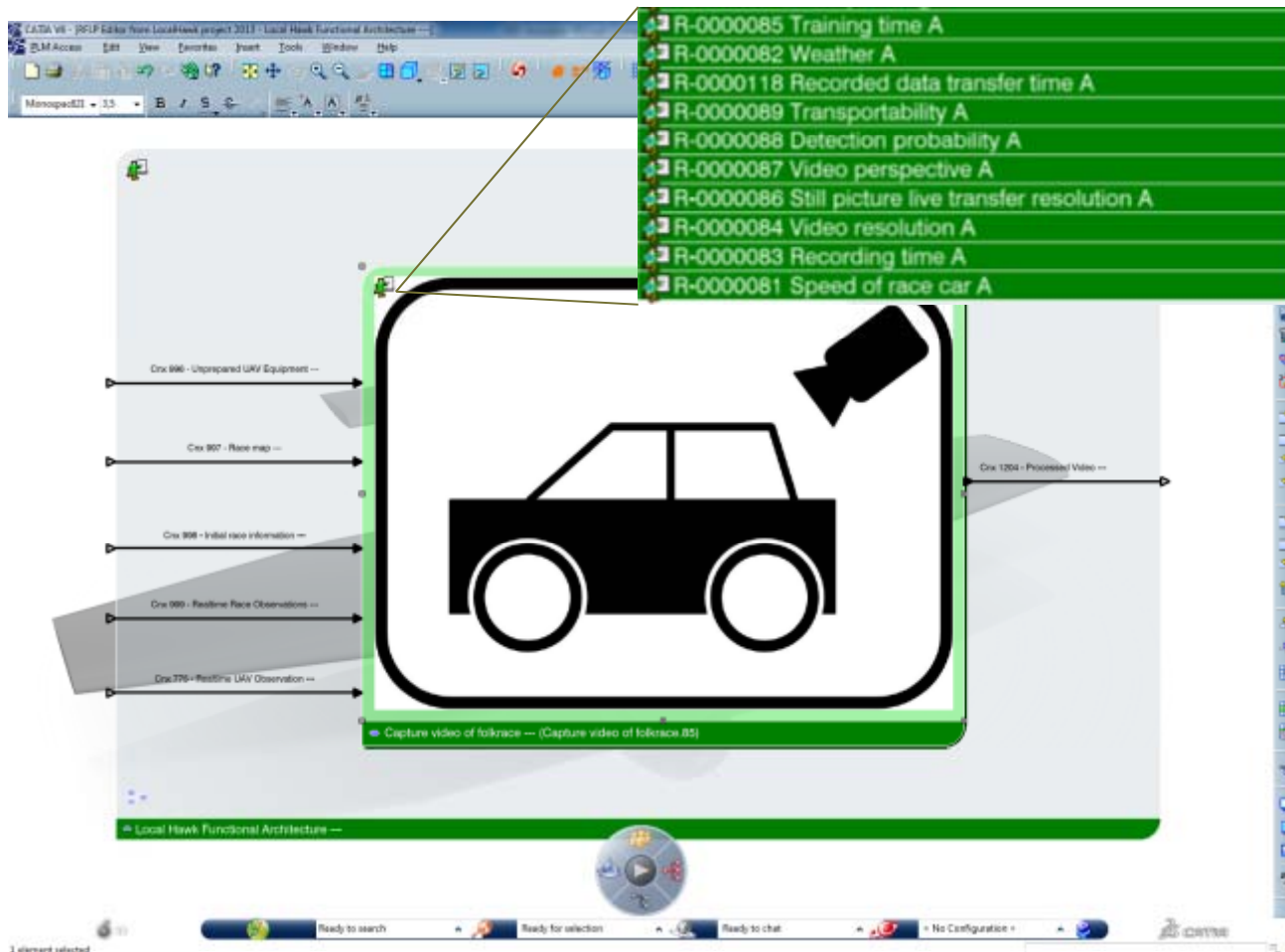
Panel 6: ...AND THE WATCHERS AT HOME CAN SOON CELEBRATE ANOTHER VICTORY FOR THEIR HERO.

Identify stakeholder needs

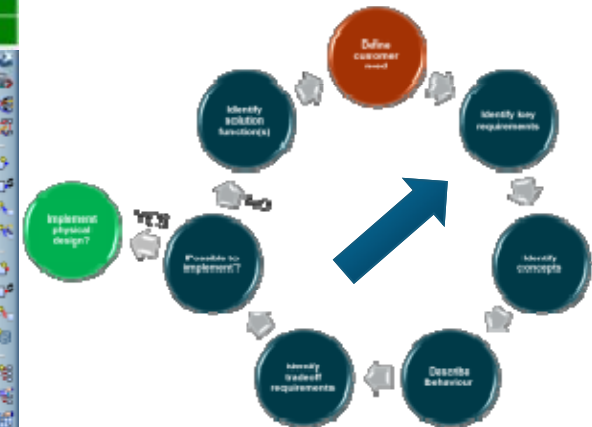


System Function:
 Capture Video of folk race

Identify Key Requirements



Identify key requirements



Requirements that drives the concept selection.

Identify Concepts

Title: Concept Decision | Project: MBSE Testbed | Author: Torfinn Tobliassen. | Date: 17.04.13

1. Custom RC propeller aircraft

2. Controllable crane

3. Quad copter

4. Zeppelin

5. Single rotor copter

6. RC jet plane

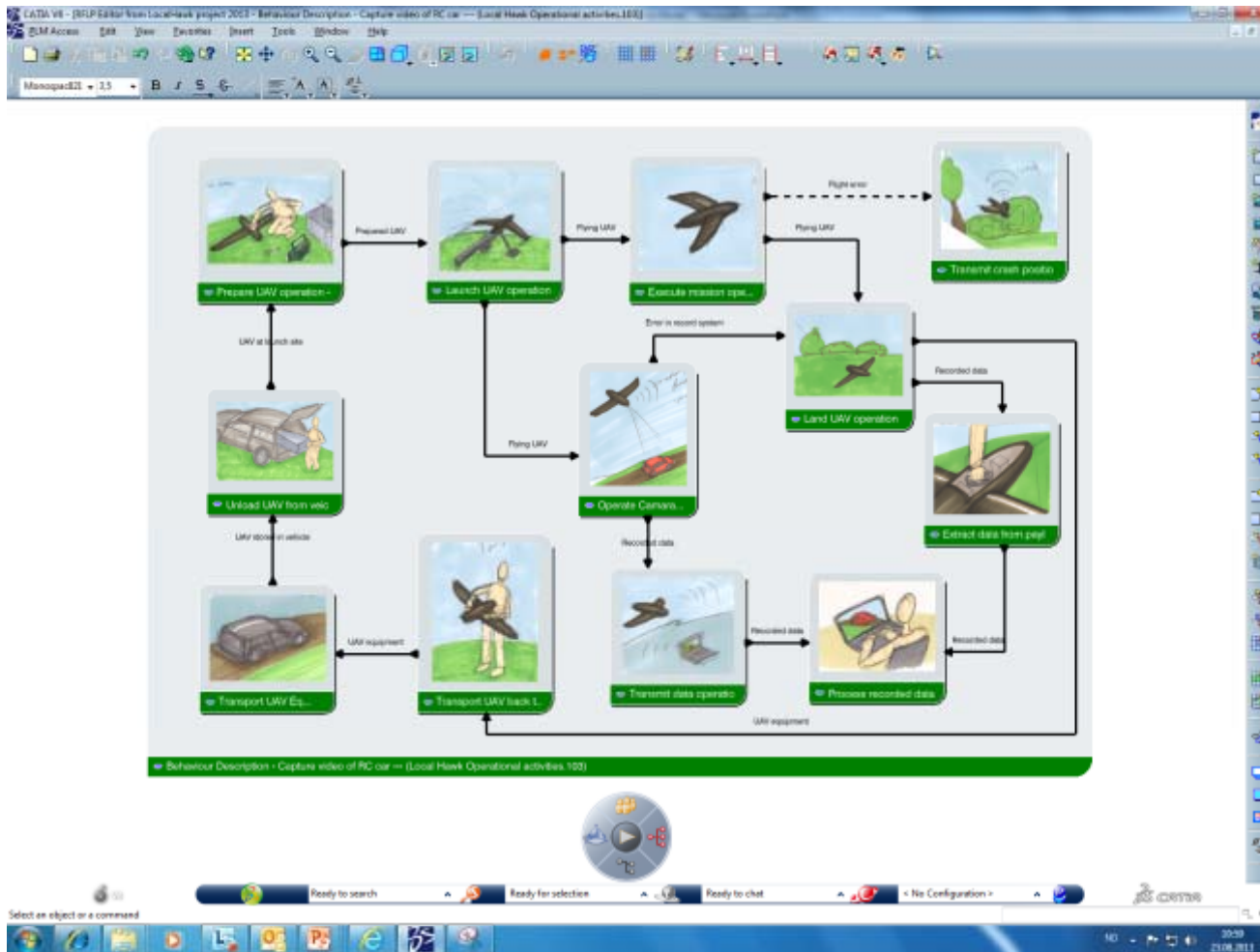
Requirement Categories (1 good - 6 bad)	Service cost	Development cost	Maintenance requirements	Transition ability	Logistics	Technical complexity	Functional performance	Score
Custom propeller aircraft	2	3	3	1	1	3	2	15
Controllable crane	3	3	1	5	5	2	6	26
Quad copter	1	3	3	1	1	3	3	15
Zeppelin	6	6	3	6	6	6	4	37
Single rotor copter	1	3	4	1	1	3	3	16
RC jet plane	2	3	3	1	1	4	5	19

The preferred concept is a fixed wing aircraft using the shape to generate aerodynamic forces and a propeller to generate thrust.

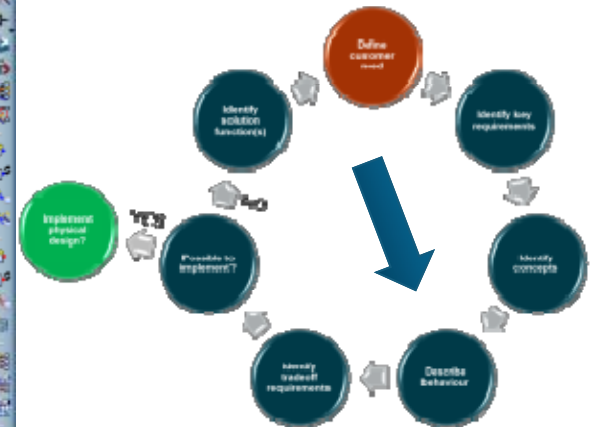
Identify concepts



Describe concept behaviour

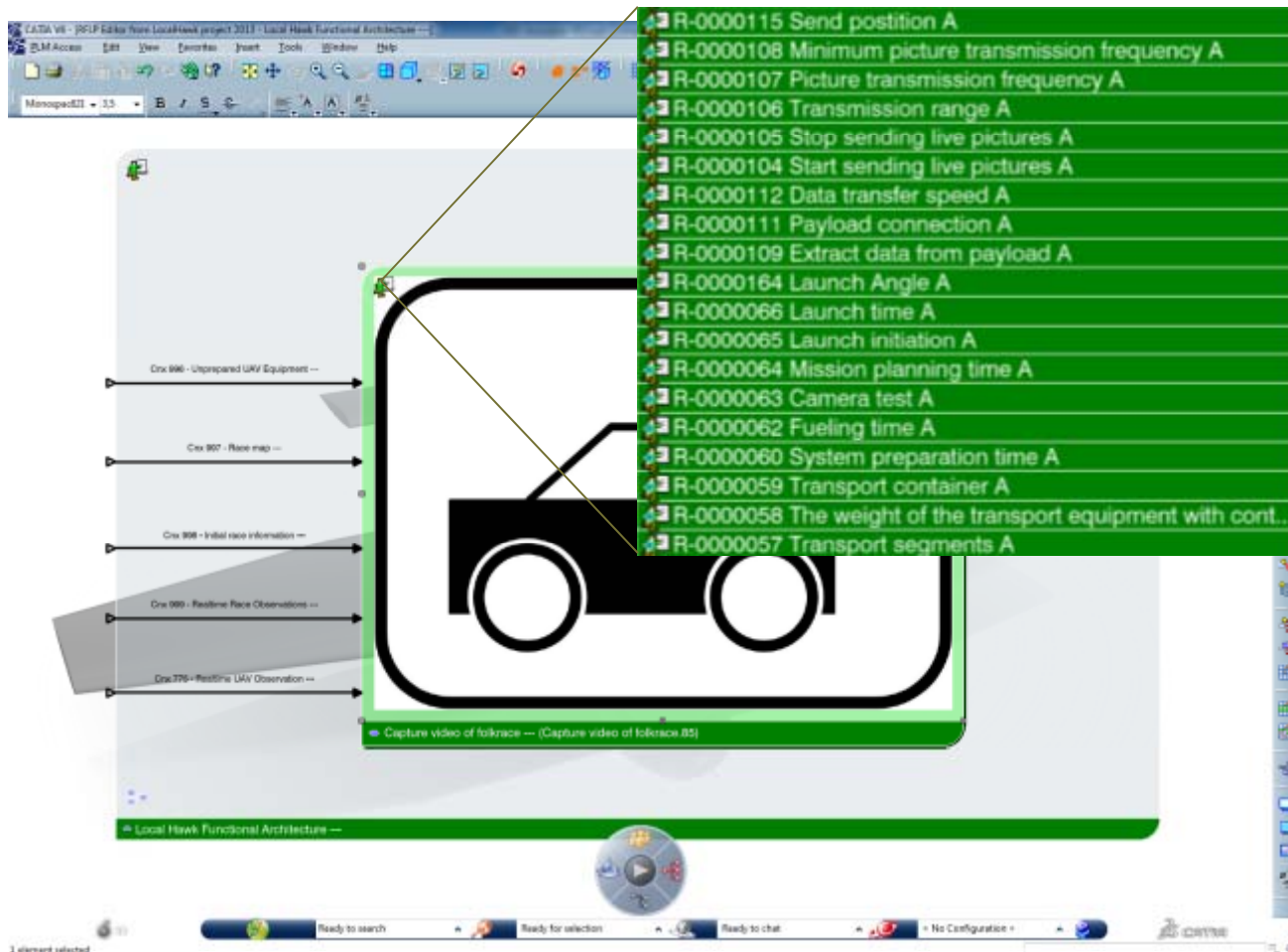


Describe concept behaviour

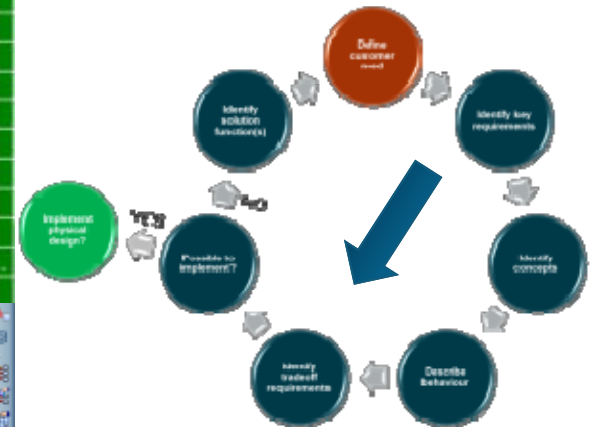


How the concept elements shall behave and cooperate

Identify tradeoff requirements

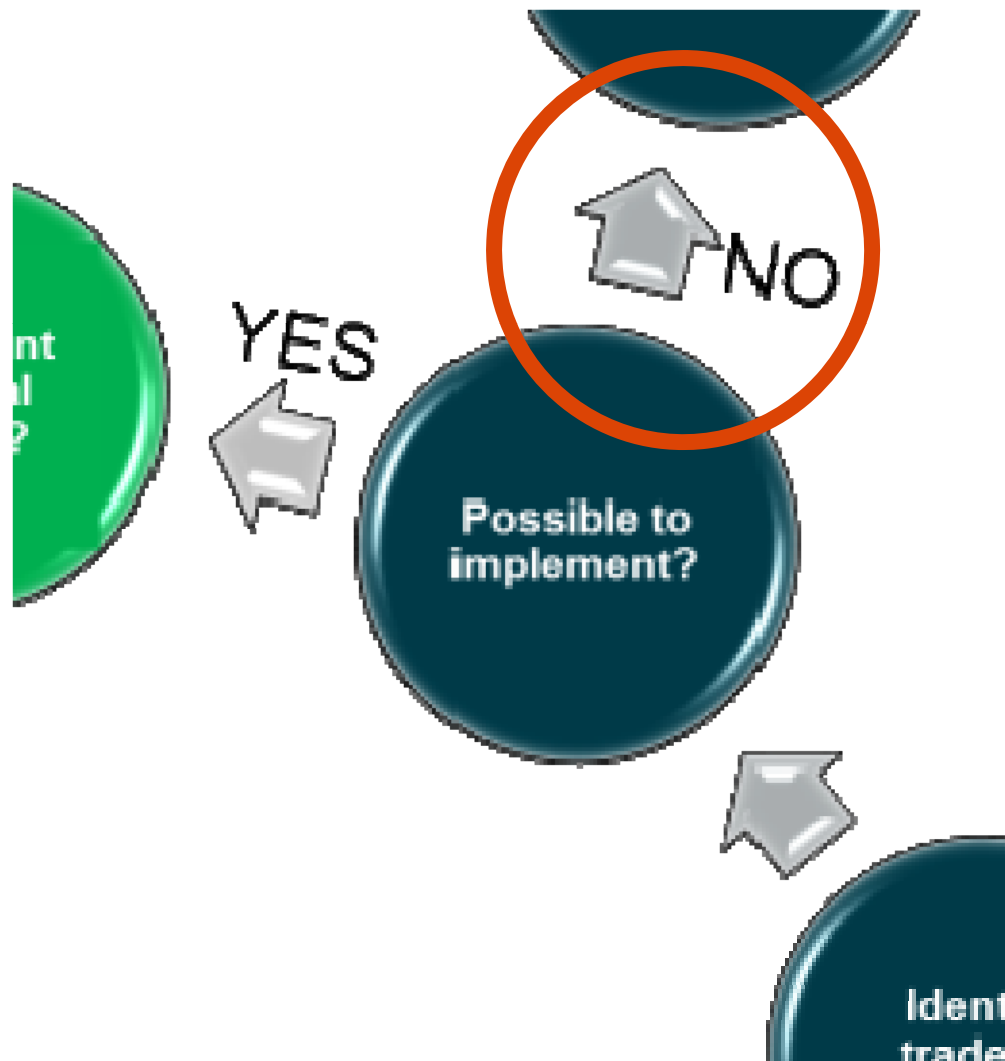


Identify tradeoff requirements

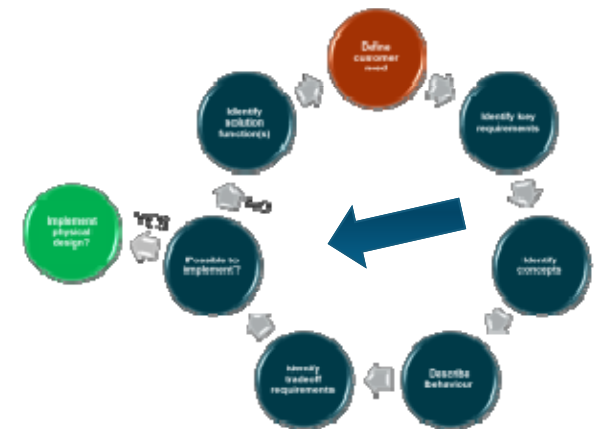


Requirements that are an unavoidable consequence of the concept selection.

Possible to implement (Make, Buy or Reuse)

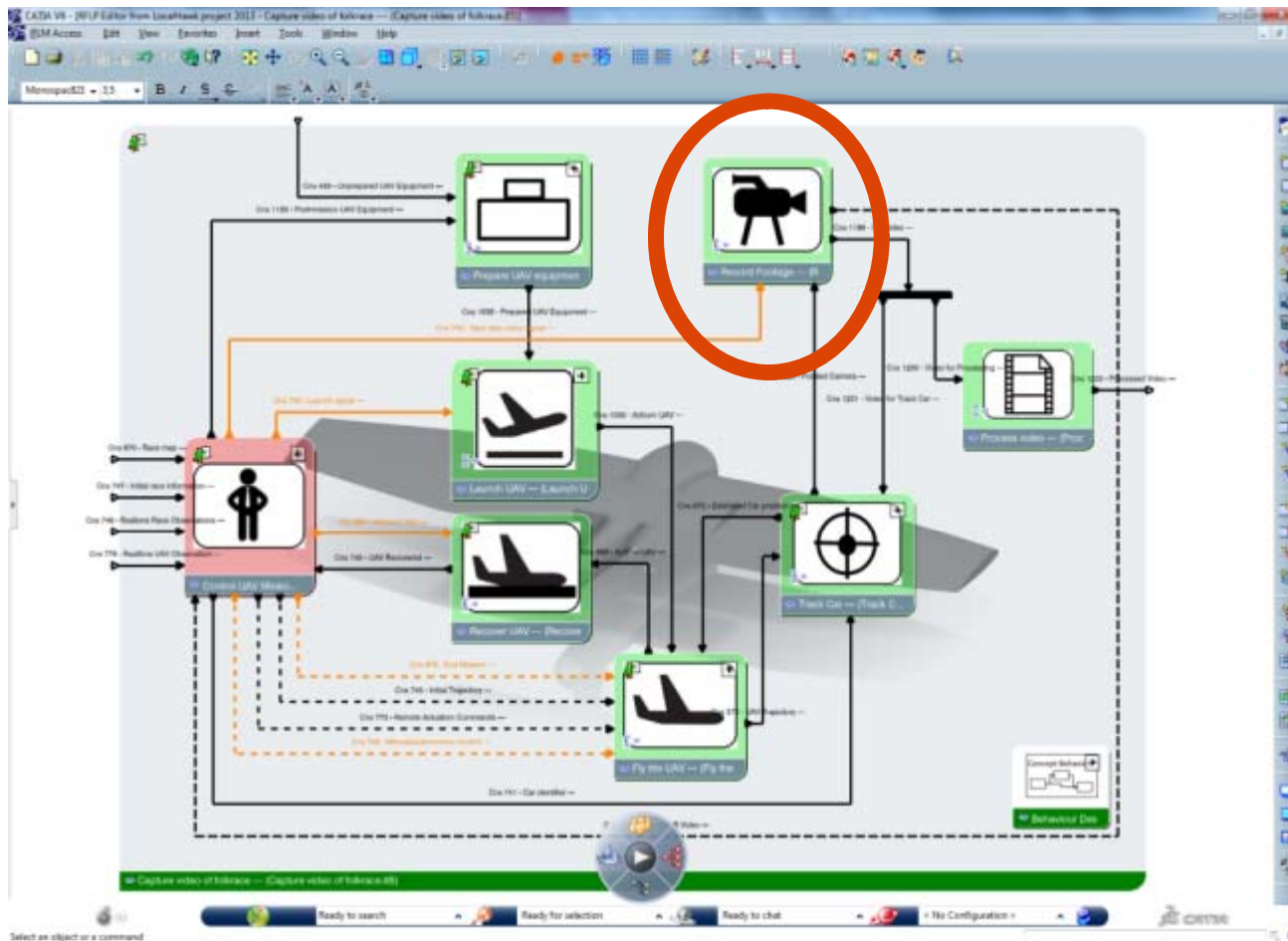


Implementable (Make/buy)

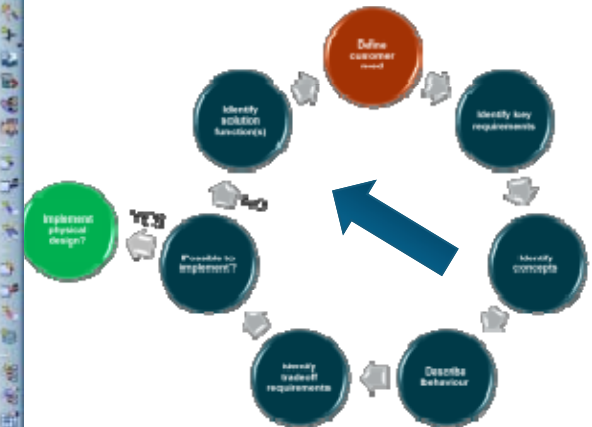


What set of functions must be developed to enable the behavioral requirements on the concept

Identify solution function(s)



Identify solution Function(s)



Sub functions needed to «capture video of a folks race from a birds perspective»

Next level

Define need for «Record footage»

Title: Scenario capture footage	Project: Local Hawk	Author: Khang	Date: 220813 Last update: 23.06.2013 12:50
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The UAV is flying at 50 meter altitude. Searching for a car.

The car is spotted, videos and pictures are captured.

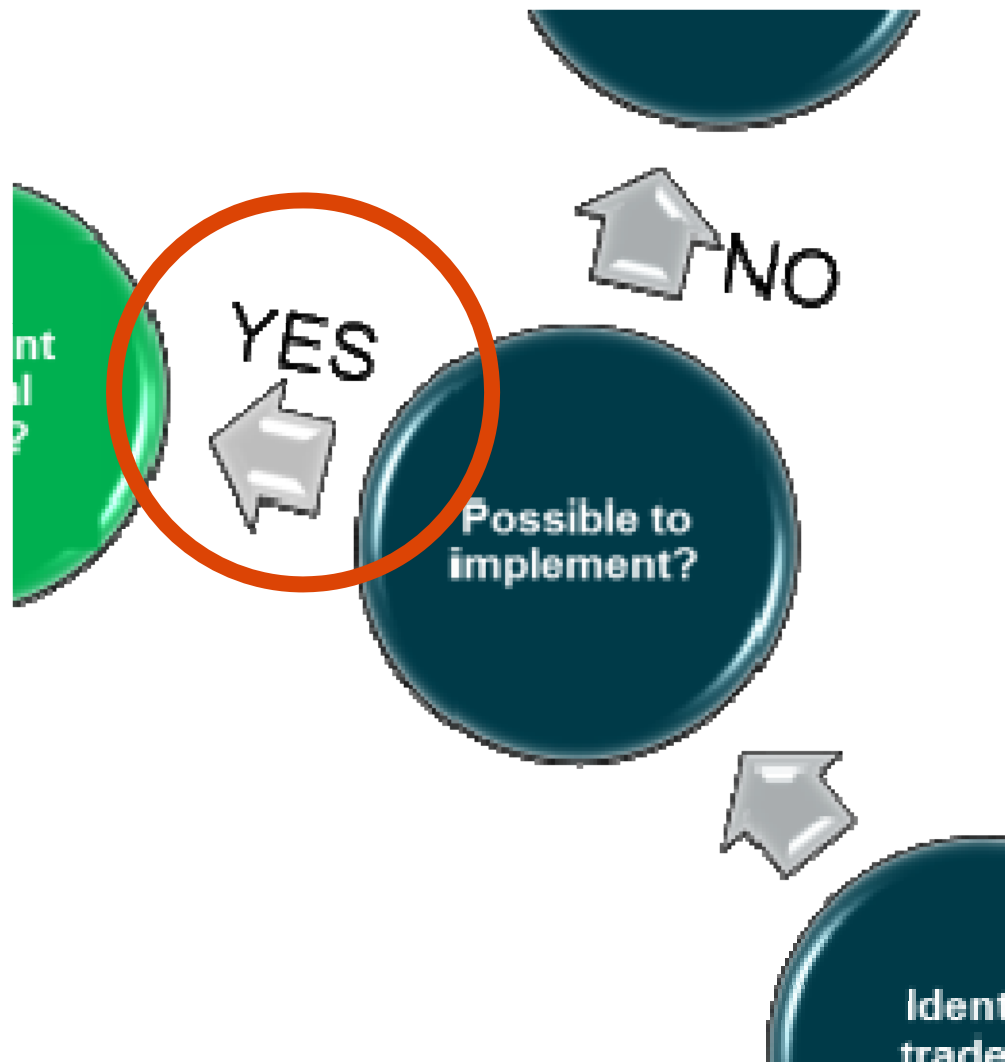
Audience is watching live still pictures from the race

Audience watch HD videos of the folk race after the camera and UAV has landed.

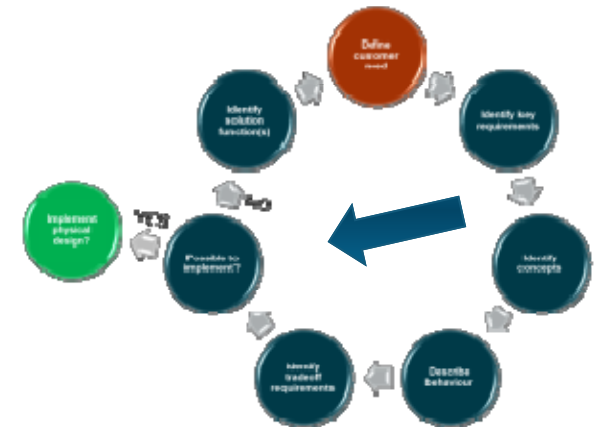
Define need



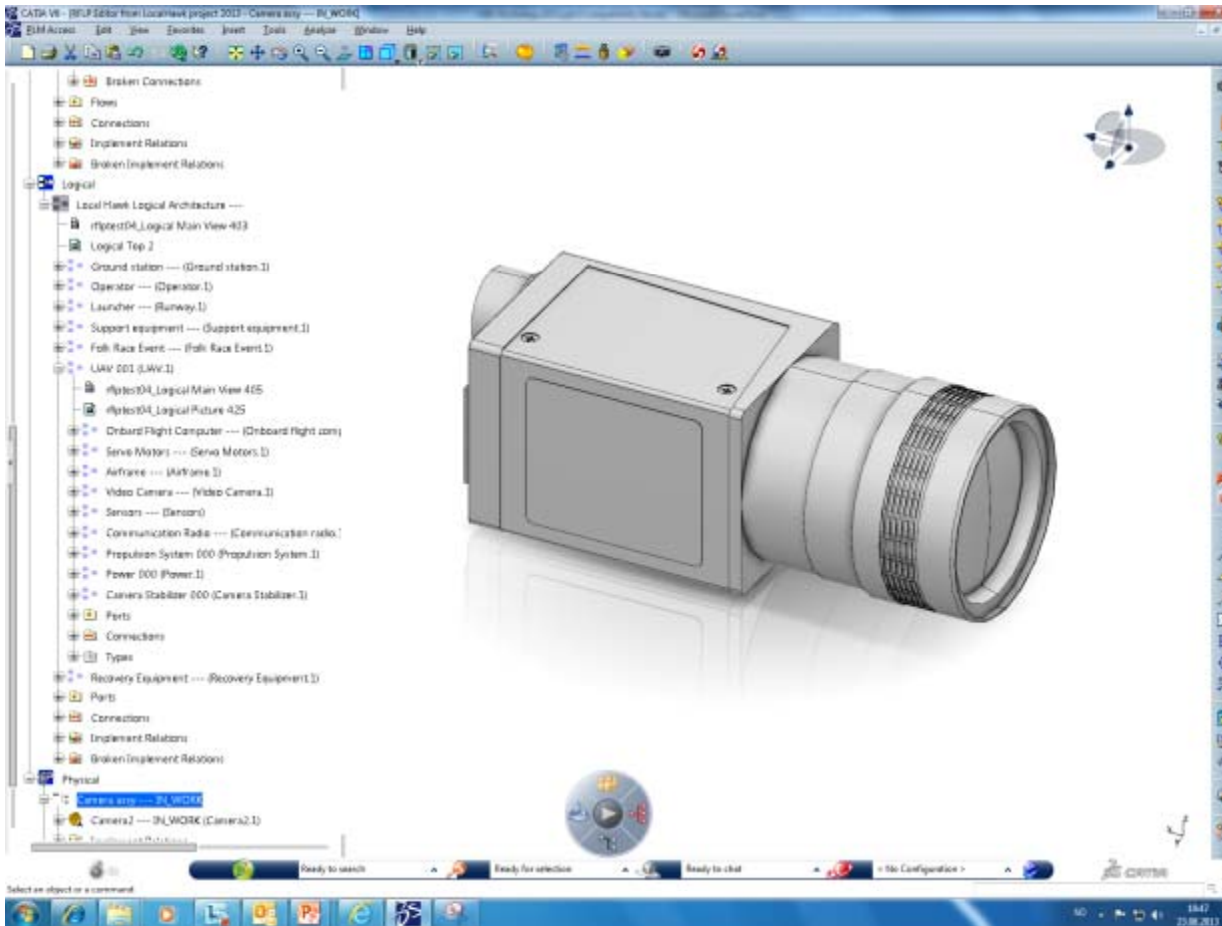
Possible to implement (Make or Buy)



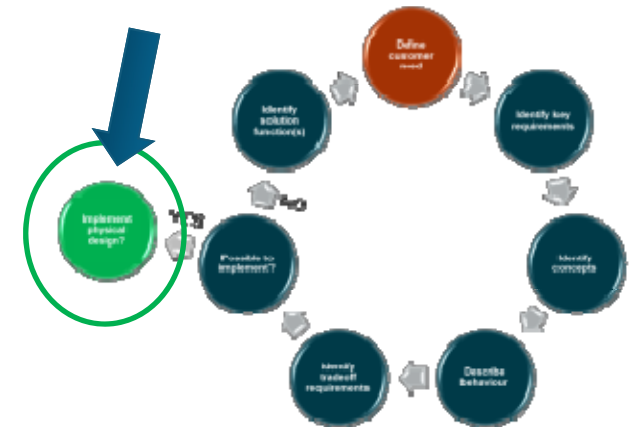
Implementable (Make/buy)



Implement (physical) solution «Record Footage»

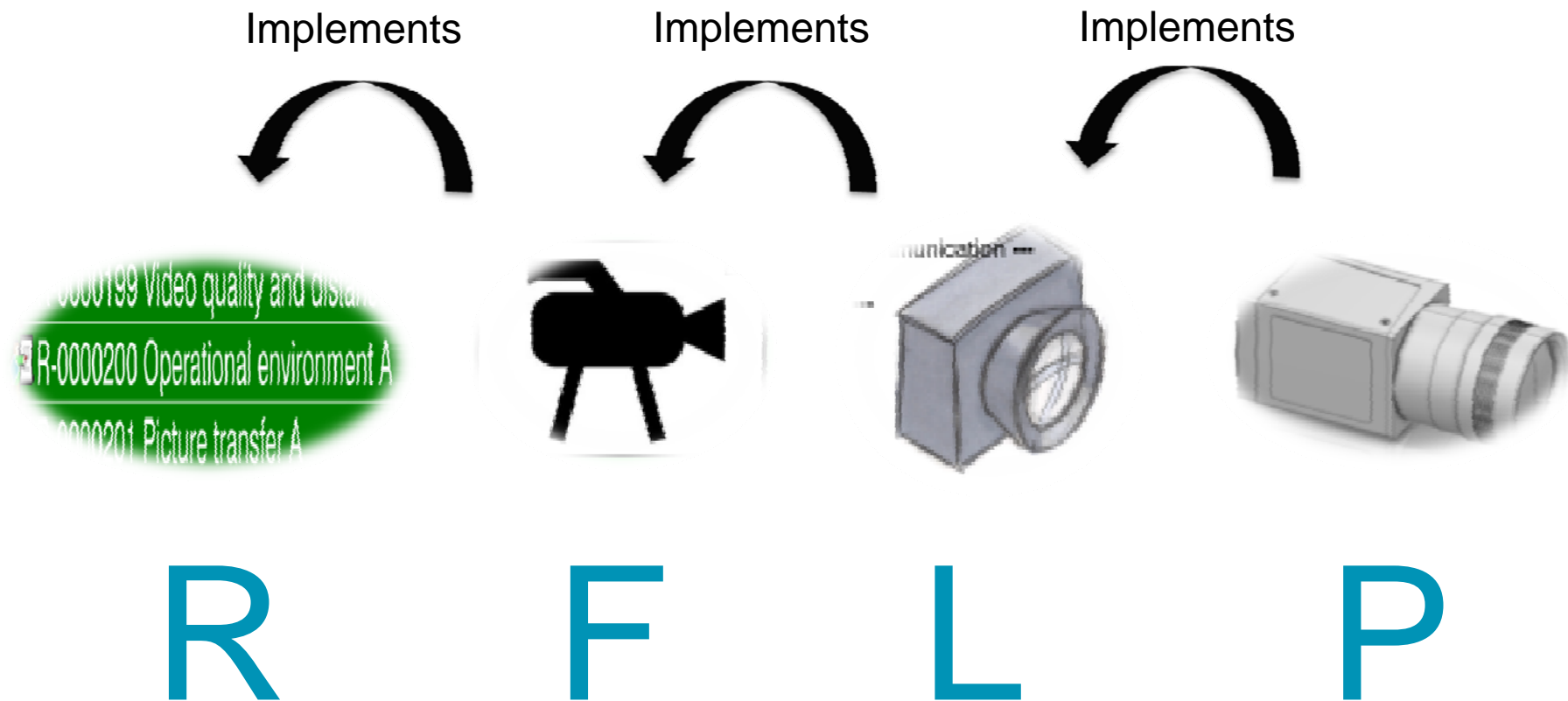


Implement physical design



Brand and type of camera selected (purchased) and integrated in the physical solution

All SE artifacts are related The need, the function is the driver!



Session Takeaways

- Students Project are key enablers for business transformation initiatives
 - “real life” engineering assignments and challenges
 - Industrial practices , know how, « Intellectual Capital » storage
 - « innovation » mindset and related enhancement propositions
- Project organisation and « Collaborative » Systems Engineering tools platform required
- Local Hawk RFLP Systems Engineering Models are ready for next summer





Questions ?



TECHNIA
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kongsberg.com
3ds.com
Technia.com



KONGSBERG

Torfinn.TOBIASSEN@kongsberg.com
Magnus.FALKMAN@technia.com

Presenter:
Thierry.AMBROISINE@3ds.com
Dassault Systèmes
+33 1 61 62 82 46