"Concept Laboratory"
at LiTH

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EWADE 2007 Samara

Goals

- Concept realisation in smaller scale
- Create means and methods to design and manufacture simpler to more advanced flyable models for concept evaluation and flight testing
- Customers: industry, research institutes and universites

Why?

- Difficult to draw conclusions from just "paperwork"
- Need of a tool for risk assessment
- Evaluation of handling qualities
- C of G at the right place?
- Expensive to manufacture "in-house"
- Complements more expensive testing

How?

- Create a process
- CATIA V5- design tool to interface with customer
- Build on in-house developed sizing program
- Consider scale effects
- Create database for propulsion means
- Create manufacturing processes for different types of models
- Flight testing methodology

Background - Studentprojects

2002-2003
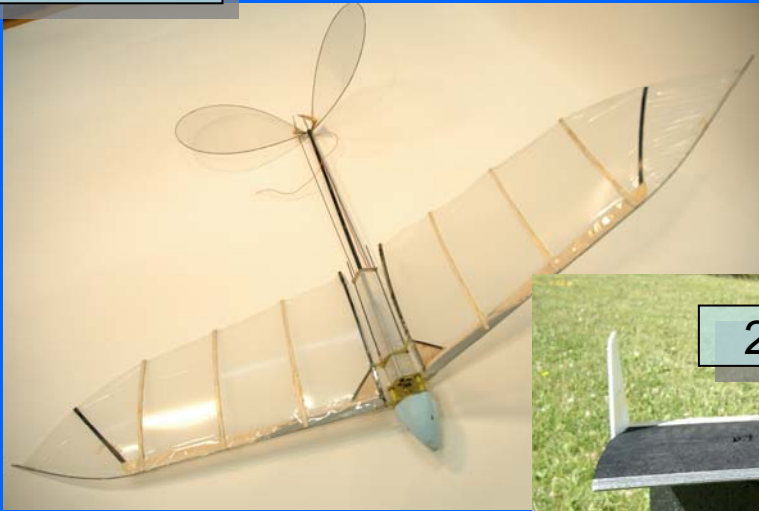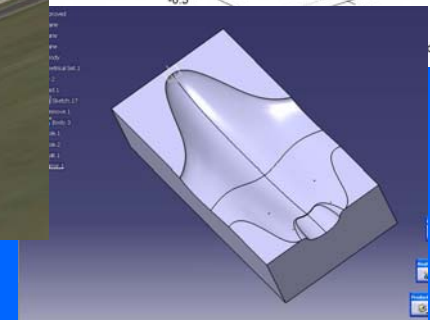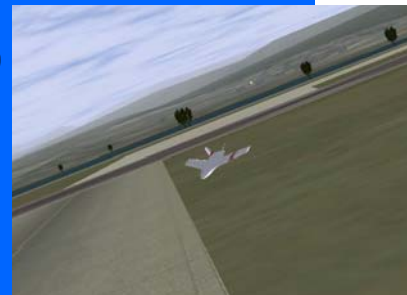
1999

2004

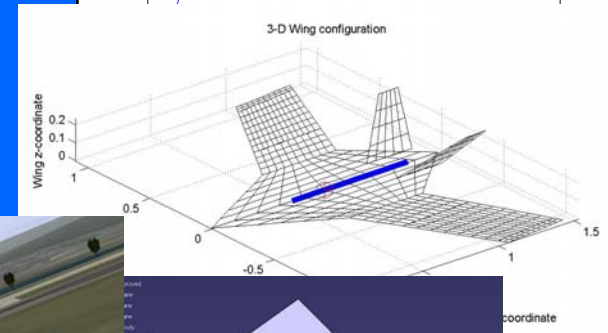2000
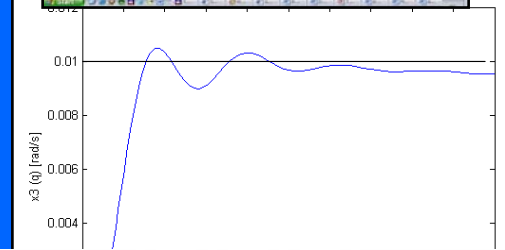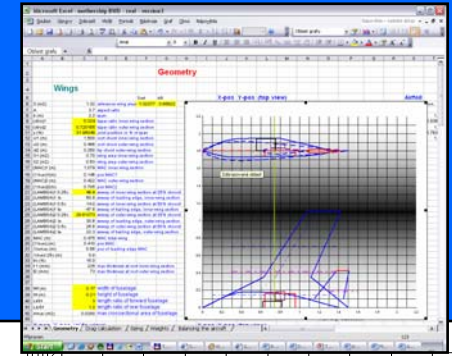
2001

Manta-2005
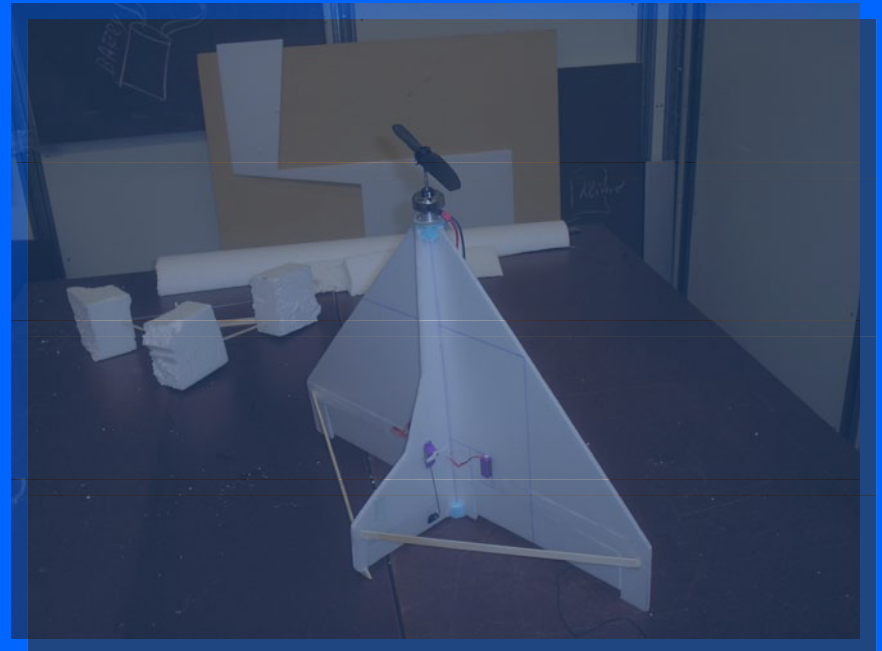
Munin-2006

Tools

- Sizing Program in Excel
- Matlab
  - Aerodynamic (Tornado, KTH)
  - Flight Mechanic (DATCOM)
- Catia V5 (design)
- Flight Gear (simulation)

International teamwork

Test of different concepts for vertical take off

• Excel sheet :

• **Geometry :**

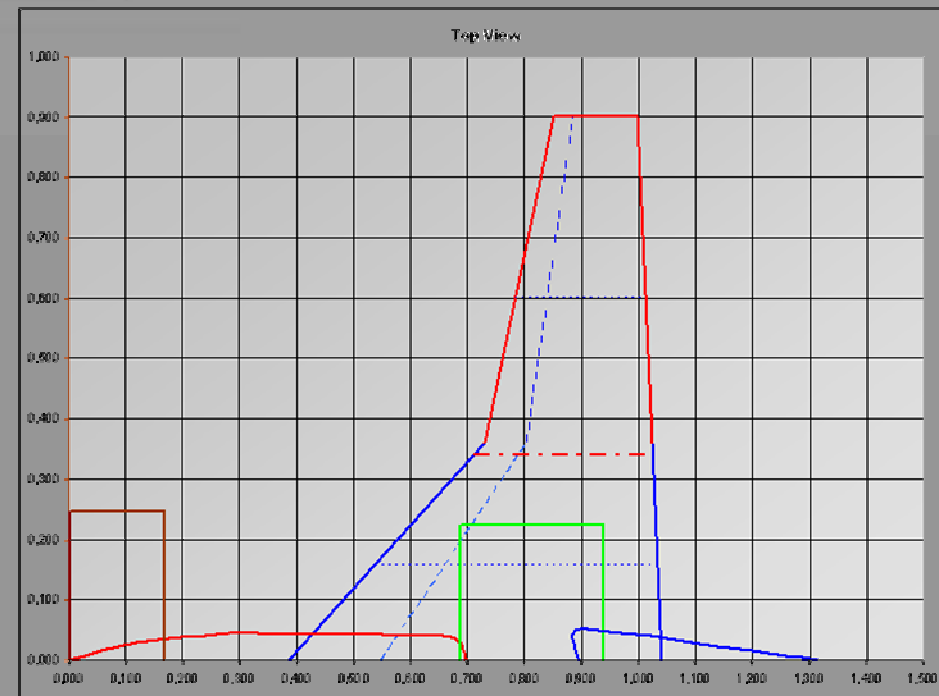•Main Wing: Referance area .580 m^2

   Span 1.800 m

   Aspect Ratio 5.600

Section one Taper ratio .450

            Leading edge sweep 43.340
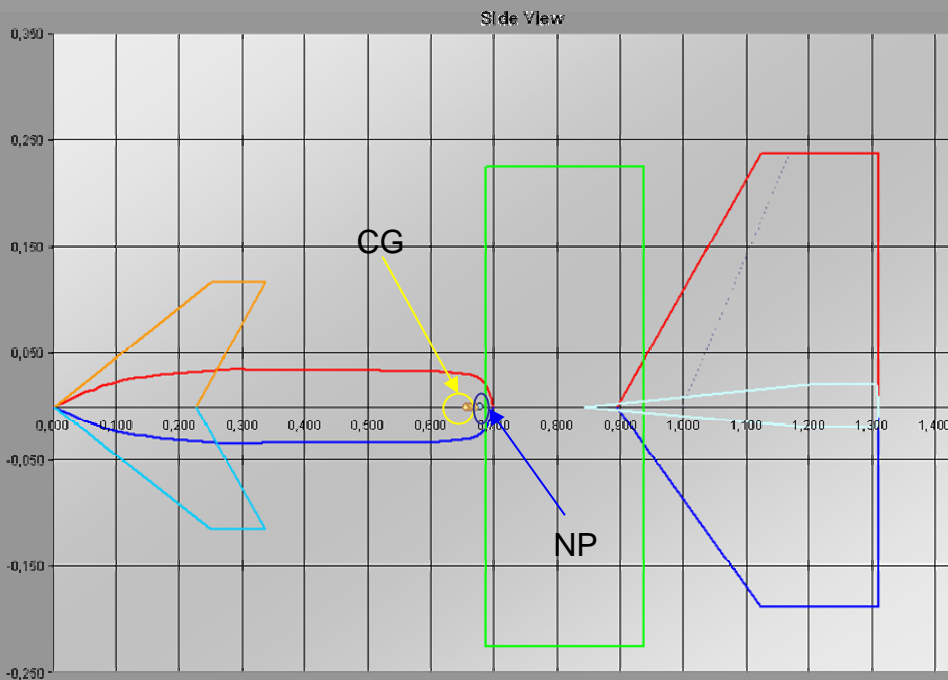
Section two   Taper ratio .504

            Leading edge sweep 12.253


Top View

• Excel sheet :

  • **Balance:**

Side View graph showing CG and NP positions.

Component	Mass (kg)	x (m)	y (m)	z (m)		Ix
Battery	0,120	0,510	0			0,061
Black box	0,000	0,000				0,000
Canard	0,053	0,126	0	0,000		0,007
Conventional landing gear	0,100	0,000				0,000
Dorsal fin	0,020	0,141	0	0,000		0,003
Duct	0,293	0,813	0	0,000		0,238
Engine+prop	1,500	0,650				0,975
Engine mount	0,050	0,600				0,030
Fuselage	0,108	0,500	0	0,000		0,054
Fuel tank	0,075	0,530				0,040
Gyro	0,050	0,300				0,015
Horisontal stabiliser	0,000	1,200	0	0,000		0,000
Receiver	0,040	0,900				0,036
Servo 1 right aileron	0,049	0,900				0,044
Servo 2 left aileron	0,049	0,900				0,044
Servo 3 vertical fin	0,049	1,000				0,049
Servo 4 throttle	0,030	0,400				0,012
Servo 5 vertical fin lowerside	0,027	0,800	0	0,000		0,022
Servo 6	0,000	0,000	0	0,000		0,000
Vertical stabiliser upper side	0,104	1,157	0	0,099		0,121
Vertical stabiliser lower side	0,085	1,157	0	-0,089		0,099
Wing inner part	0,430	0,734	0	0,000		0,315
Wing outer part	0,193	0,871	0	0,000		0,168
Winglet	0,015	1,105	0			0,017
Extras	0,050	1,100				0,055
Aluminium Beam	0,089	0,836	0			0,075
Payload	0,300	0,4				0,120
gasoline FULL	0,480	0,530				0,2544
gasoline 75%	0,360	0,530				0,1908
gasoline 50%	0,240	0,530				0,1272
gasoline 25%	0,120	0,530				0,0636

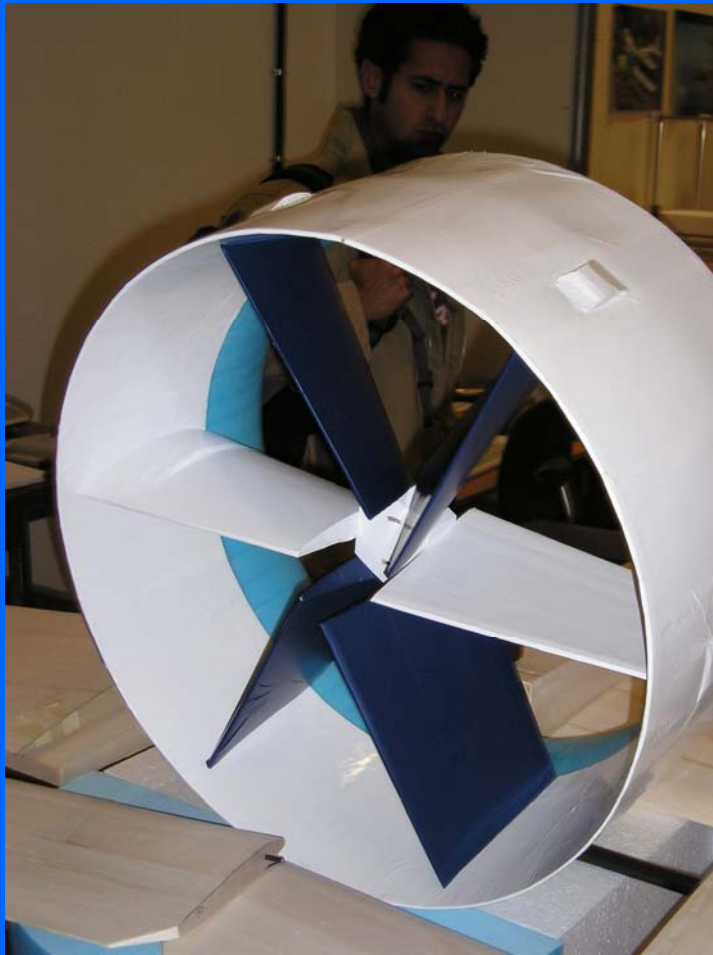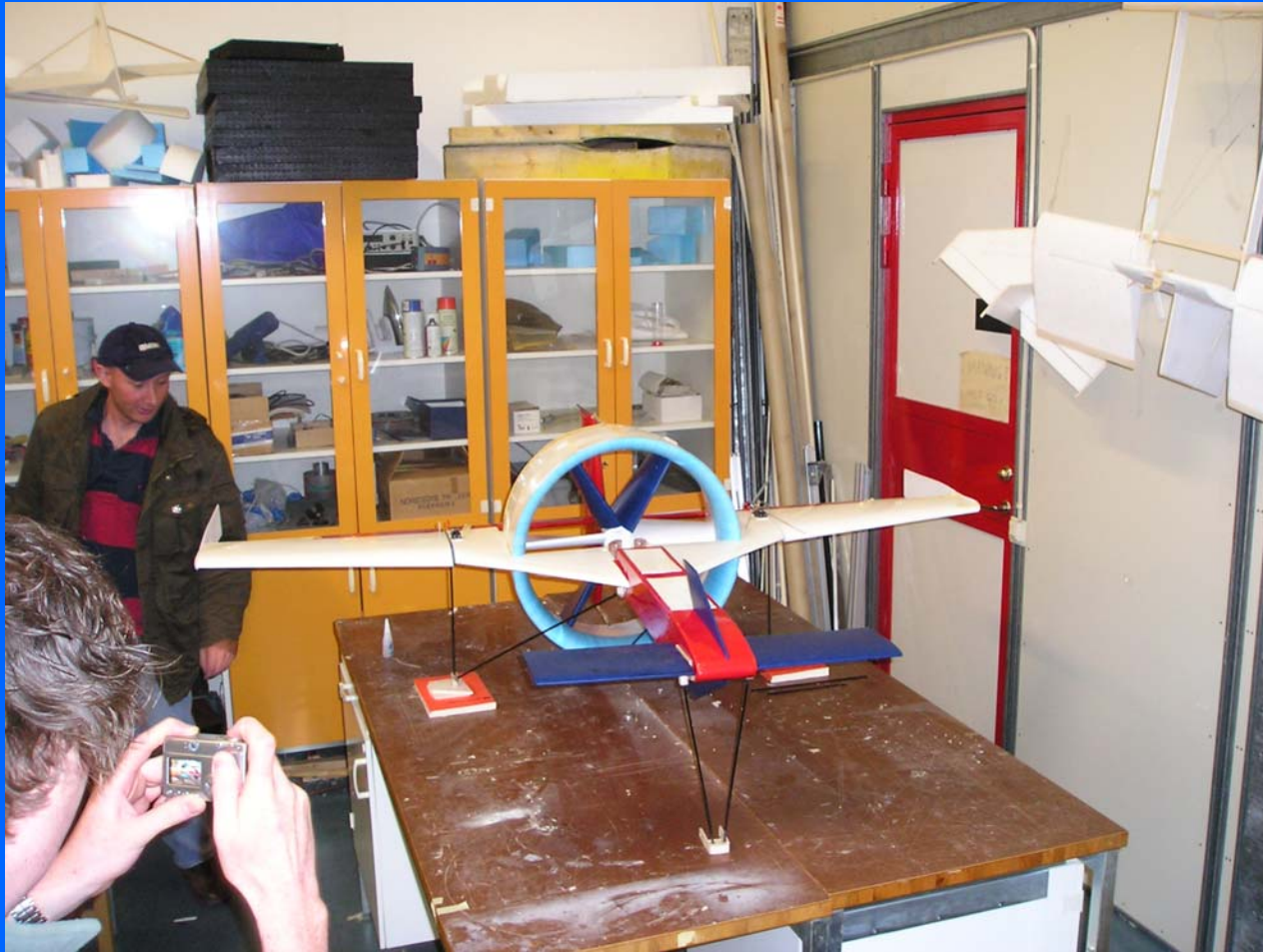|				Static Margin	
Total Empty Weight	3,879	0,670	0,000	2,6%	2,598
Total at 25 % Fuel	3,999	0,666	0,000	3,9%	2,662
Total at 50 % Fuel	4,119	0,662	0,000	5,2%	2,725
Total at 75% Fuel	4,239	0,658	0,000	6,4%	2,789
Total at 100% Fuel	4,359	0,654	0,000	7,5%	2,852

VTOL Project

• CATIA :
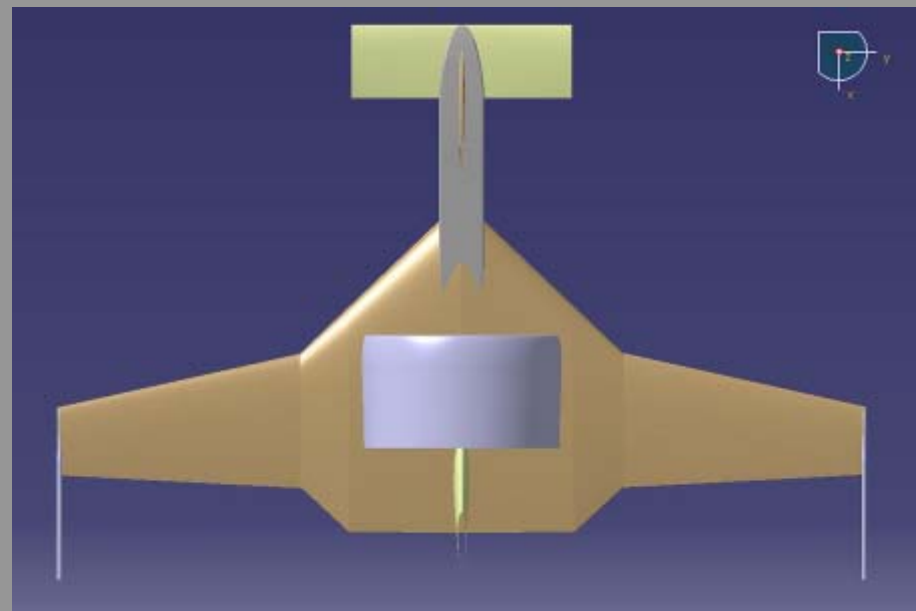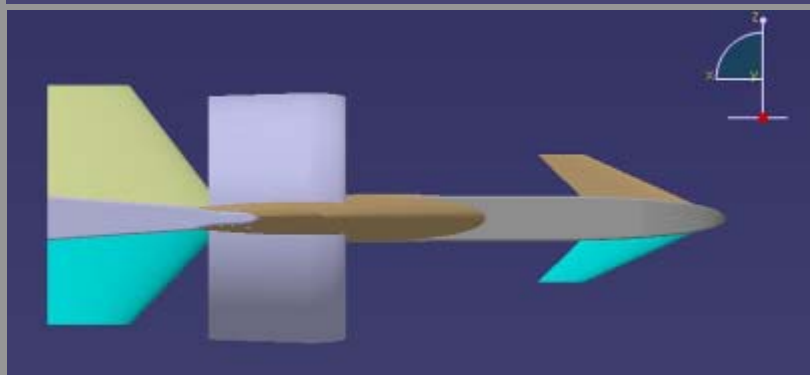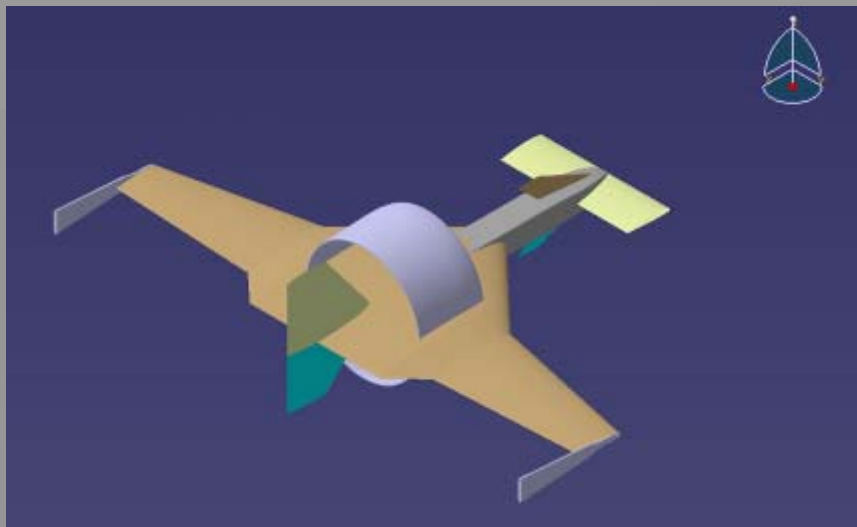
Manufacturing

Manufacturing

Full Scale Version in Composite (Custumer: Linklab)