Advanced Ultra-light and U.A.V. Synergic Family Studied at Politecnico di Torino

- Sergio CHIESA – Full Professor, A.S.S.E.T.
- Sabrina CORPINO – Assistant Professor, A.S.S.E.T.
- Nicole VIOLA – Researcher, A.S.S.E.T.
- Marco FIORITI – Ph.D. Student, A.S.S.E.T.
The context of this presentation is the very first phase of an aircraft development program: specifications are not well defined yet, marketing considerations are relevant, but technical activities are already of great interest:
POLITECNICO di TORINO
MISSION:

RESEARCH

EDUCATION

TECHNOLOGY DISSEMINATION

TECHNOLOGICAL "SPIN-OFF"

Sergio CHIESA
Advanced Ultra-light and U.A.V. Synergic Family Studied at Politecnico di Torino:

ULTRA LIGHT AIRCRAFT: NEW CONCEPTS UNDER STUDY AT POLITECNICO DI TORINO

S. Chiesa, S. Corpino, M. Fioriti, N. Viola
Department of Aeronautics and Space Engineering (DIASp)
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• RESEARCH ACTIVITY ABOUT NEW U.L.M. (Founded by Piemonte Regional Government)
• INTEGRATED with a previous educational initiative based on 3-years Degree Thesis
• PRESENTED by the Authors at RRDPAAE-2006

INFLUENCES by OTHER ACTIVITIES

INOLVEMENT OF Prof. S. CHIESA AS TECHNICAL CONSULTANT IN A LEGAL QUESTION BETWEEN TWO U.L.M. MANUFACTURERS
RESEARCH ABOUT NEW U.L.M.

- Conceptual Design
- 3D-CAD Parametric Modeling
- Verifications/Investigations by Means of the Scaled Flying Model
- D’Alpa Thesis
- Masero Thesis
- Sartori Thesis

Possible future developments of research on ultra light ac:

Future U.L. “3”
(Recent study)

Light surveillance UAV
Sergio CHIESA

U. L. “widebody”

U. L. “JET”

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HOW THE IDEA HAS BEEN CONCEIVED?

DECISION ABOUT “DRIVERS” TO BE CONSIDERED:

- PRE-DESIGN TECHNICAL STUDIES
- ECONOMICAL-MARKET STUDIES
- FLIGHT PERFORMANCES (maxSpeed, Range)
- FIELD PERFORMANCES
- SAFETY
- APPEAL
- LOW COST
SEARCH FOR A BETTER “SYNTHESIS” ! ! !

(*) Hypothesis of non professional Pilot !

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SEARCH FOR A BETTER “SYNTHESIS”: 

- FLIGHT PERFORMANCE (maxSpeed, Range)
- FIELD PERFORMANCE
- SAFETY
- APPEAL
- LOW COST

- GOOD AERODYNAMICS
  NO BRACING
- LOW “WING LOADING”
- “3 LIFTING SURFACES”-”V” TAIL LAY-OUT
- … + ALTERNATIVE ENGINES
- PARTS INTERCHANGEABILITY & SYNERGIC VERSIONS
AERODYNAMICS & ARCHITECTURE

INTERCHANGEABILITY OF PARTS

ALTERNATIVE ENGINES

SYNERGIC VERSIONS
PRE-DESIGN TECHNICAL STUDIES

Landing gear still to be defined
ROTAX (basic version)

ALTERNATIVE ENGINES

DIESEL “ZOCHÉ”

Microtubo TRS18 (Thrust =120kg)
U.A.V. PLATFORM → H.A.L.E. operations

- Removed Canards Surfaces / Increased Wing Area & Aspect Ratio
- Retractable Landing Gear
- Diesel Engine
LOW WING VARIANT → CRASH SAFETY

- Retractable Landing Gear
- Lower body SHIELD (to be studied)
A QUITE SIMILAR DESIGN
(of some years ago):

The Aceair AERIKS 200 is a Swiss sports plane of highly unusual design. It is being marketed in kitplane form. The AERIKS 200 has a highly-streamlined, bullet-shaped fuselage, with a T-tail and large ventral fin, pusher propeller, and canard. The pilot and passenger are seated in tandem. Development aircraft have fixed undercarriage.

Status
Aceair ceased operation in 2004, and with it the Aeriks 200 project was cancelled. Ths was principally due to Diamond Engines cancelling the manufacture of the rotary engine the 200 was based around.

Our Study is independent by engine!
The following slides are taken from final report of Students Work in Economics and Business Course
Innovative ULM Modules
Business Assessment Report

Entrepreneur – Professor Chiesa Sergio

Realized By:
- Assice Dorian [France]
- Fioriti Marco [Italy]
- Gawron Wioleta [Poland]
- Tronco Vicente [Brazil]

Under the Coordination of – Gervasoni Luca

Gruppo
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The Project, The Idea, The Challenge

• Value Proposition
  • Market Needs & Product Features
  • Product Description

• The Market Assessment
  • A Luxury Market Niche
  • Starting off in Europe

• The Industry Assessment
  • Porter’s 5 Force Analysis
  • A Sustainable Competitive Advantage

• Sales Forecast
  • Per Product
  • Per Market

• Conclusion
Market Needs & Product Features

The 4 S’s

Stall free
Sporty
Safety & Comfort
Style & Appealing Aerodynamic Design

Flying has never been Safer, never been Easier!
Porter 5 Force Analysis

- **Barriers to the entry**
  - Investment costs very high
  - High technological Knowledge necessary

- **Suppliers**
  - Highly dependent on suppliers
  - One supplier per Component

- **Substitute Products:**
  - Paragliders, hang-gliders, multi-axis, gyroplanes, hot-air balloons
  - Price and performance extremely different

- **Competitors**
  - Highly nebulous industry, small competitors
  - Lack of innovation
  - No leader

- **Buyers**
  - Strong power
  - To be treated with particular attention

Constituted of a highly **nebulous industry** with many small competitors this industry **lacks innovation** and has above all **no leader** which is **an opportunity for the entrepreneur to acquire a strong position.**
A Sustainable Competitive Advantage

• The 3 Winged Technology
  - Stall Free
  - Unusual and Attractive esthetical aspect
  - Strong element of differentiation
  - Shortens Takeoff and Landing Distances

• Modularity
  - Interchangeable Engine [Diesel, Fuel, Jet]
  - One conception - 3 Products:
    - The 3 Winged ULM
    - The LOW WING (“Crash Safe”) ULM
    - UAV and Ultra Light Jet

• Materials
  - Aluminum
    - Great Know how, Widespread, Common
    - Easy to copy, rough design

  - Composite Materials
    - Sophisticated Design, Light
    - Good guarantee against copying
    - Higher Investment,
    - Higher Cost of the final product

Sergio CHIESA
Some technical activities are now starting in order to better focus “Business Opportunities”

TRADE – OFF ALUMINIUM ALLOY vs COMPOSITES
Alluminium Version Study
But a lot of work is waiting for us!

THANK YOU FOR YOUR ATTENTION!