

Small Group Discussion

Safety Standards of University Rockets

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< Discussion Members >

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< Purpose >

To date, many universities worldwide actively conduct their small rocket launches based on the individual safety standards or regulations established by the own clubs or the organizations they belong to. The main purpose of the safety standards is to secure the safety of launch members and personnel of the third party, but shall not ties down the students by the strict rules to spoil their motivation for innovative ideas. The safety standard has a purpose to help the students to investigate how the conformity to the safety can be achieved by their own ways, such as calculations or actual ground tests prior to the actual launch.

The agenda of discussion is as follows:

1. Introduction of safety standards in each country (11:35 - 12:00)
2. Discussion on the safety standards for further enhancement (13:00 - 14:45)
3. Draft of International safety standard (14:45 - 15:30)
4. Wrap up conclusion (15:30 - 15:50)

Introduction of

- 1. NASA - University Student Launch Initiative 2009-2010 (USA)**
- 2. FAA - Rules for Rockets 2007 (USA)**
- 3. National Association of Rocketry - High Power Rocket Safety Code 2012 (USA)**
- 4. Planete Science_CNES - Book of Specifications Single Stage Experimental Rockets (France)**
- 5. UNISEC – Safety Standard for Rocket Development Ver. 6 (Japan)**
- 6. Noshiro Event – Safety Standards (Japan)**
- 7. JAXA - Safety Plan for Small Winged Rocket for Evaluating Flight Environment Adaptive/ Optimal Guidance and Control System (Japan)**

Discussion Issues

- 1. What is the purpose of “Safety”?**
- 2. What kinds of information are necessary to discuss “Safety”?**
- 3. How to certificate “Safety”, by analysis or tests?**
- 4. Who approves “Safety”?**
- 5. How to improve “Safety”?**

- **What affects on the safety of the rocket**
 - **Design**
 - Structure, Aerodynamics, Physics, Propulsion...
 - **Laboratory**
 - Experimenting facilities...
 - **Personal**
 - Clothing, Gloves, Glasses, Double check mind...
 - **Manufacturing**
 - No reactive tools, Machines...
 - **Launch**
 - Permission of public institution, Ignition Procedures...



All of these
things are
linked!

Safety Code of UNISEC Global (1/6)

1. **Definition of Safety**
 - Not for the rocket but for the human life

2. **Design of Rocket**
 - 2.0 **Mission Definition**
 - 2.1 **Major Dimensions**
 - 2.2 **Flight Profile**
 - 2.3 **Aerodynamic Characteristics and Stability Margin**
 - 2.4 **Propulsion System**
 - 2.5 **Structure**
 - 2.6 **Avionics and Power Supply**
 - 2.7 **Actuation System**
 - 2.8 **Recovery System**
 - 2.9 **Payload Integration**



To be included,
for validating the
safety.

Safety Code of UNISEC Global (2/6)

- 3. Ground Support Equipment**
 - 3.1 Launcher**
 - 3.2 Propellant/ Oxidizer Supply and Ignition System**
 - 3.3 Telemetry System**
 - 3.4 Emergency Uplink System**

- 4. Flight Operation**
 - 4.1 Pre-Flight Preparation**
 - 4.2 Flight Operation and Check Manuals**
 - Ignition Criteria**
 - Reversible Operation**
 - Counter measures for major Failures**
 - Recovering method of Rocket after the flight**
 - Post-flight operations**
 - 4.4 Weather condition**

Safety Code of UNISEC Global (3/6)

5. Analysis

5.1 Mass Characteristics

5.2 Trajectory Analysis

(1) Effect of Wind

(2) Launch Elevation

(3) Ground points analysis

5.3 Loads Calculation

(1) Aerodynamic Load

(2) Thrust Load

(3) Parachute Deployment Load

(4) Touch Down Load

Safety Code of UNISEC Global (4/6)

- 5.4 Strength of Structure
 - (1) Wing
 - (2) Body
 - (3) Fins
 - (4) Parachute and Riser
- 5.5 Software Analysis
- 5.6 Thermal Analysis
- 5.7 Aerodynamics Analysis

- 6. Test
 - 6.1 Structure Test
 - 6.2 Sub-System Functional Test
 - 6.3 Avionics Test
 - 6.4 Integration Test
 - 6.5 Combustion Test
 - 6.6 Hardware in the Loop Test
 - 6.7 Rehearsal
 - 6.8 Post Flight Review

Safety Code of UNISEC Global (5/6)

- 7. Hazard & Safety Analysis**
 - 7.1 Safety Distance of Propulsion System**
 - 7.2 Safe Zone determination**
 - 7.2 FTA (Fault Tree Analysis)**
 - 7.3 FMEA (Failure Mode and Effect Analysis)**

- 8. Design Review and Approval of Flight**
 - 8.1 Design Review**
 - 8.2 Pre-flight Review**
 - 8.3 Post-flight Review**
 - 8.3 Organizations to Contact for Flight**
 - 8.4 Approval of Flight**

Safety Code of UNISEC Global (6/6)

9. Project Management

9.1 Team Organization and Supervisors

-Technology Transfer

-Educational

9.2 Development and Flight Test Schedule

9.3 WBS (Work Break Down Structure)

9.4 Parts List

9.5 Budget Management

9.6 Regulations

9.7 Documentation

- Home work: Group 5 will issue **the draft of full “Safety Code of UNISEC”** by the end of March.