

Small Group Discussion

Safety Standards of University Rockets

November 20, 2014



Moderator: Prof. Dr. Koichi Yonemoto (Kyushu Institute of Technology, Japan)

< Discussion Members >

- **Prof. Barbara Bermúdez-Reyes (Autonomous University of Nuevo León, Mexico)**
- **Prof. Ernest Teye Matey (All Nations University College, Ghana)**
- **Mr. Kiho Fukaura (Tsukuba University, Japan)**
- **Mr. Yosuke Fujisawa (Kyushu University, Japan)**
- **Mr. Guna Surendra (Kyushu Institute of Technology, Japan/India)**

< 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) |

< References > CDs are provided for the discussion members

- 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”?**

- Discussion result (contents of safety code) will be presented by students (16:30-16:35pm).
- Home work: Group 5 will issue **the draft of full “Safety Code of UNISEC”** by the end of May.

Safety Code of UNISEC Global (1/6)

Draft

1. Definition of Safety
2. Design of Rocket
 - 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

Safety Code of UNISEC Global (2/6)

Draft

3. Ground Support Equipment

3.1 Launcher

3.2 Propellant/ Oxidizer Supply and Ignition System

3.2 Telemetry System

3.3 Emergency Uplink System

4. Flight Operation

4.1 Pre-Flight Preparation

4.2 Flight Operation and Check Manuals

4.3 Post-work

Safety Code of UNISEC Global (3/6)

Draft

5. Analysis

5.1 Parts List and Mass Characteristics

5.2 Ground Impact Points Analysis

(1) Effect of Wind

(2) Launch Elevation

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)

Draft

5.4 Strength of Structure

- (1) Wing**
- (2) Body**
- (3) Fins**
- (4) Parachute Riser**

6. Test

- 6.1 Structure Test**
- 6.2 Sub-system Operation Test**
- 6.3 Electrical System Test**
- 6.4 Total Functional Test**

Safety Code of UNISEC Global (5/6)

Draft

7. Hazard Analysis

- 7.1 Safety Distance of Propulsion System**
- 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 Organizations to Contact for Flight**
- 8.4 Approval of Flight**

Safety Code of UNISEC Global (6/6)

Draft

9. Project Management

- 9.1 Team Organization and Supervisors**
- 9.2 Development and Flight Test Schedule**
- 9.3 WBS (Work Break Down Structure)**
- 9.4 Parts List**
- 9.5 Budget Management**