CASI Free Flight Competition
Rules and Regulations – 2006

Changes for 2006 are highlighted in light blue

Foreword

The Canadian Aeronautics and Space Institute (CASI) is an organization that represents aviation and aerospace professionals in Canada. Student members of CASI enjoy numerous benefits, and the annual CASI Free Flight Competition is one of the most exciting.

Eligibility

The Competition has been organized primarily for the benefit of CASI student members. **The first 5 participants registered by a team must be CASI members.** Additional participants are strongly encouraged (but are not required) to be CASI members. Registered guests (see below) may attend and observe the Competition, but may not participate.

Registration

Team registration packages may be sent by e-mail, fax, courier or post, and must include:

- The name of the team and the university with which it is affiliated
- The name of the CASI Branch with which the team is affiliated (if applicable)
- The names and CASI membership numbers of a maximum of 5 team members
- The address, phone number and e-mail contact for each of the team members
- Payment of the team registration fee of $267.50 (includes $17.50 GST)

Each team registration entitles up to 5 designated team members to participate in the Competition. Additional participants may be registered at a cost of $80.25 (includes $5.25 GST) each. Included in the registration fee: pizza on Friday evening, lunch on Saturday and Sunday, dinner on Saturday evening, and a souvenir CASI Free Flight Competition T-shirt.

Only **registered guests** of competing teams will be permitted access to the Competition. Fees (GST included) are:

- $80.25 -- Attendance at all Competition activities (T-shirt included)
- $12.84 -- Attendance on Friday night; or Saturday flying; or Sunday flying
- $32.10 -- Ticket for the dinner on Saturday evening

Send registration packages to:
CASI Free Flight Competition
1750 Courtwood Cr., Suite 105, Ottawa, ON K2C 2B5
Tel: (613) 234-0191 Fax: (613) 234-9039 e-mail:freeflight@casi.ca

Important dates – 2006 Competition

February 28 – Team registration packages must have been received at CASI HQ
April 20 – Written reports, submitted in **triplicate**, must have been received at CASI HQ. Submission in soft file format is also encouraged.
May 12 to 14 – Competition takes place at Gananoque Airport, Gananoque, Ontario.

Objective

The CASI Free Flight Competition was inaugurated in 1993. The main objective of the Competition is to promote learning about the basics of flight. As teams design, build and fly their aircraft, they will find that compromises are required between payload (weight) and performance (endurance, stability). These are the same compromises one has to deal with when designing a real aircraft. Since the Competition is being held outdoors it will be essential that the aircraft have considerable stability in all three axes. This is especially critical since the aircraft will be uncontrolled during flight.

The design of free flight aircraft is much more challenging than that of radio-controlled models. It is strongly suggested that students contact local model aircraft clubs for advice regarding the Competition.

Description

The goal of the Competition is to design, construct and fly an original, scratch-built, unpowered aircraft (heavier than air) that can carry the most weight in the air for the longest time. The aircraft may not be controlled in any way during its flight other than as specified below. Flight points are awarded as a function of the time that the aircraft remains aloft and the payload carried, so that trade-offs can be made in the design.

The Competition has three elements:

- a written report
- an oral presentation
- a flight event

A written report must be submitted that justifies the choice of configuration, rationalizes the aerodynamic and structural design, and describes the benefits and drawbacks of the selection. Each team will also be required to present a 15 minute oral briefing summarizing the design philosophy for their aircraft (see Scoring Sheets for marking details).

For the flight event, a member of the team tows the glider aloft. The 50-metre towline is connected to the aircraft with a 2.5 cm diameter ring and hook arrangement (Figure 1). There is a 20 x 20 cm flag attached to the end of the towline. The ring that is connected to the aircraft's hook is located above the flag (Figure 2). A rudder-centering device is usually activated while the aircraft is in tow. After release the aircraft must circle while descending. The Competition is held in a large outdoor area to allow for wind drift during the flight.

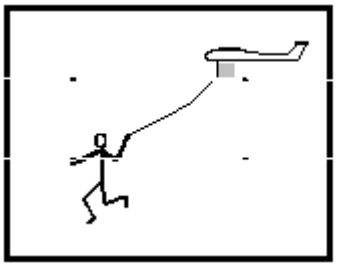

Figure 1

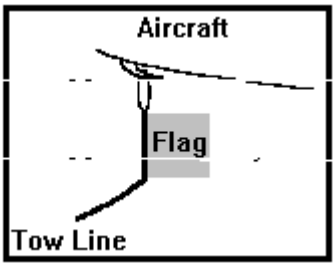

Figure 2

Safety

Safety -- of participants, bystanders, property and buildings -- and respect for the rules and regulations governing the Competition must be paramount considerations at all times. Participants are required to respect the rules and regulations, and to comply immediately with instructions given by the Meet Director, Officials and CASI organizers. Failure to do so may result in disqualification of the offending individual, and possibly of the entire team.

Decisions regarding Written Reports, Oral Presentations and flying are in the hands of the Meet Director. The Meet Director is assisted by one or more Officials.

Throughout the day as the flying part of the Competition takes place, the Meet Director and/or other Officials will make decisions regarding whether, when and where to fly as conditions change. Safety will always be the primary concern. Teams must listen for and follow instructions given immediately before each flight.

The most important rule is to **STOP, LOOK AND LISTEN** whenever approaching a runway, and to **YIELD** to any other activities at the airport. **FAILURE TO OBSERVE THIS RULE WILL RESULT IN IMMEDIATE EJECTION OF THE INDIVIDUAL(S) INVOLVED FROM THE COMPETITION AND FROM THE AIRFIELD.**

Judging

All rulings by Officials will be promptly communicated to all contestants. Protests by a team in respect of the actions of another team must be presented to the Meet Director or designate, in writing, within 15 minutes of a perceived infraction. The protesting team will forfeit 5 points if the protest is not upheld.

Rulings made by Officials are final. Team members or supporters who argue with Officials risk disqualification of the offending individual(s) and the team from further competition.

General rules

Hand towing by means of the supplied towline is the only method that may be used to propel the aircraft during launch.

Only one aircraft may be flown per team. The same airframe may not compete in different years. The same institution may field two or more competing teams. Care must be taken by the teams to avoid a degree of similarity in the design of their aircraft, and in the Written Reports and the Oral Presentations, that the Officials might deem unacceptable.

The original configuration of the aircraft with its inherent limitations must be maintained throughout the Competition, without modifications. If the aircraft is damaged it may be repaired; however major structural elements may not be replaced.

The aircraft must be designed and built entirely by the competitors. During the Competition, team advisors may offer verbal assistance only. They must not participate in the repair or flying of the aircraft.

All contestants must respect the spirit of competition and the principles of fair play.

Aircraft design

The aircraft must fit within a 2 metre by 2 metre square with a maximum height of one metre. The team chooses how the aircraft is positioned within this imaginary box.

The maximum empty weight – that is, the total weight excluding only the payload – of the aircraft may not exceed 900 grams, or be less than 600 grams.

The nose of the fuselage of the aircraft must be blunted so as to reduce the risk of injury to participants and bystanders and damage to property that could result from impact. The radius of curvature of the nose of the fuselage must be not less than 50 mm (2 inches), flat-faced to the wind. The material from which the nose is made must have the pliability of expanded polypropylene foam. If the aircraft incorporates an external pod (such as may be used for carrying the payload) the pod must also meet this nose radius requirement. The design of the blunted nose/pod must prevent punch-through of the fuselage or any other part of the aircraft upon impact. A tapered shape may be used for the downstream half of the nose/pod.

If an aircraft is damaged or compromised in any way such that safety in competition is a concern, Officials may withhold permission to fly until the aircraft is made safe.

A dethermalizing device must be built into the aircraft that is capable of limiting maximum flight time to just over 75 seconds. The recommended approach for most aircraft is a tip-up tailplane, triggered by a mechanical timer or by a radio-controlled device with a single radio channel. Fuse-operated dethermalizing devices are not permitted. If a radio control is used to trigger the dethermalizer, an Official will hold the transmitter until 75 seconds have elapsed at which time the transmitter will be handed over to the team for activation. No other remote control of any part of the aircraft is permitted. The dethermalizing device must demonstrate functionality to the satisfaction of the Officials prior to flying.

Aircraft designs may be traditional or unconventional, and some designs may incorporate innovative features. Teams should ensure that any 'unique or innovative solutions' incorporated into the design of an aircraft demonstrably improve its performance.

Written report

The written report will consist of a maximum of 30 pages (including appendices) of double-spaced text, drawings and calculations. Font size should be 12 point. No specific format is required, but points are awarded for organization and clarity. Include important calculations in the appendices. Keep the report as short as possible.

The report should emphasize design philosophy. What were the critical factors in the configuration? Why did the team decide on one solution rather than another? Be sure to point out unique or innovative solutions incorporated into the aircraft. Provide some technical analysis of the design. In particular an assessment of the structural strength of the wing should be included. This may take the form either of an analysis or of a structural test.

A three-view must be provided along with any structural or aerodynamic details that may be of interest. Up to five 11" x 17" drawings may be included. Smaller sizes are permitted.

Teams are responsible for ensuring that their written report arrives at CASI HQ on or before the date mentioned on Page 1. A penalty of 5% per day of the total marks possible will be applied to reports received at CASI HQ after the deadline. For example, a report received at CASI HQ 10 days late would have its mark reduced by 50% (5% per day x 10 days).

Copies of the winning reports from the previous two years are available to all teams upon request.

Oral presentation

Oral presentations will be given on Friday evening. The presentation must not exceed a time limit of 10 minutes. No more than two team members may participate in the presentation. A MS PowerPoint set-up will be available for use by the teams.

Flying

Prior to attempting the first scoring flight, each aircraft must demonstrate fit within the 2m x 2m x 1m jig, satisfactory functionality of a dethermalizer, and stable flight without any payload following either a towed flight or a hand-launch.

Competitors must use the supplied towlines for scoring flights. Two towlines are provided consisting of 50-metre lengths of 50-lb test monofilament line. The towlines have a handle at one end and a flag and ring arrangement at the other.

The recommended launch method involves three team members. One person provides the motive power, another holds and casts the aircraft once sufficient tension has been developed in the towline, and the third observes the other two and provides instructions to them. For best results, the full 50-metre length of the towline should be used.

Teams should await optimal wind conditions during their 5-minute 'flight window'.

The aircraft must be engaged in the towline ring at the start of the flight, must have disengaged from the ring prior to landing, and must demonstrate circling flight after towline separation with a flight diameter not exceeding about 50 metres. If any one of these criteria is not met, the flight attempt does not count. Flight time is the interval between separation of the towline from the aircraft and the first contact of any part of the aircraft with the ground. Flights of less than 5 seconds duration are not counted.

The weight of the payload carried by the aircraft will be ascertained immediately before every flight. The payload shall consist of weights that do not participate in the functioning of the aircraft (aerodynamic or structural). Teams are responsible for supplying their own payloads, the weight of which will be checked prior to use in flight. Size and distribution of the payload may be modified between flights.

Teams may fly their aircraft as often as they wish. A lineup of teams ready and waiting for permission to launch will form on a first-come, first-served basis. The aircraft must be in the line to hold a place, and team members may not reserve a position in the take-off line while repairs are being made to the aircraft in the pits.

Teams have five minutes to launch their gliders once the Official has given the signal for take-off. If a glider is not launched within the 5-minute 'flight window' the team loses its turn and must go to the back of the line. A team is deemed to have completed its turn if either a 5-second flight is accomplished, or the 5-minute 'flight window' elapses, whichever comes first.

If there are no other teams in line, a team that has completed its turn may immediately take another turn.

All teams will fly on the first day of the event. At the discretion of the Meet Director, should conditions warrant, only the six teams with the highest total marks at the end of the first day may be permitted to advance to the finals and fly on the second day of the Competition. In the event of bad weather, Officials may alter the scheduling of the Competition.

Scoring

The maximum total score is 100 points, distributed as follows:

1. for the **written report: 25 points.** The team scoring highest on the written report will be awarded 25 points. All other teams will receive a score equal to the ratio of their score on the written report to that of the best team, multiplied by 25.
2. for the **oral presentation: 15 points.** The team scoring highest on the oral presentation will be awarded 15 points. All other teams will receive a score equal to the ratio of their score on the oral presentation to that of the best team, multiplied by 15.
3. for the **flying: 60 points.** A maximum of 20 points may be earned during each of the three flying periods: Saturday morning, Saturday afternoon, and Sunday morning. The team with the highest flight score in a single period will be awarded 20 flight points. All other teams will obtain flight points equal to the ratio of their flight score to that of the best team, multiplied by 20.

The score for each flight will be determined on the following basis:
Flight Score = (Payload/Aircraft empty weight in grams) * (Time in seconds) ^{2} * 10 $^{-1}$

Competitors may accumulate as many flights as they wish throughout the flying periods. At the discretion of the Officials there will be up to three time periods: from start of flying until lunch on Saturday; from after lunch to the end of flying on Saturday; and all flights on Sunday. The best three flights for each team during each time period will be summed to provide the score for that period.

A 'complete' flight is one of at least five seconds duration. The minimum 5-second requirement for a scoring flight encourages test flying prior to the actual contest so that scoring flights can be achieved from the start of competitive flying on Saturday morning.

For the purposes of scoring, only the first 75 seconds of a flight are counted. If the flight of an aircraft exceeds 75 seconds, the Official in charge may instruct that the de-thermalizer be activated and the flight terminated.

Awards

The winning team will have its name inscribed on the CASI Free Flight Competition Trophy and will receive a replica of the Trophy to keep and display permanently.

Cash prizes will be given for the following placings:

- $500 for the first place overall finish
- $200 for the second place overall finish
- $100 for the third place overall finish

Scoring Sheets

I WRITTEN REPORT - 25 marks

Team		Scale - %					Weight	Score
		100	75	50	25	0		
Presentation	Organization						2	
	Clarity						2	
	Readability						3	
	Grammar, spelling						1	
Structure	Table of Contents						1	
	Introduction						2	
	Summary						3	
	Tables, graphs and figures						2	
	Appendices						1	
Design Philosophy	Identification of critical factors						4	
	Consideration of alternatives						4	
	Unique or innovative solutions						6	
	Depth of technical analysis						4	
Penalties								
TOTAL								
Score = Scale * Weight		**Total = Sum of Scores**				**Max = 35**		

Scale:	0%	Very Poor	No attempt
	25%	Poor	Token effort
	50%	Average	Reasonable effort
	75%	Good	Valiant effort
	100%	Excellent	Professional quality, outstanding

Penalties may be imposed at the discretion of the Officials in respect of a Written Report -- for example receipt after the deadline, or demonstration of an unacceptable degree of similarity between competing teams.

Notes

Organization	The report is well organized, providing easy and logical access to information.
Clarity	The presentation of the information is well thought out, succinct.
Readability	The report is interesting and entertaining.
Grammar, spelling	English usage and spelling are correct.
Table of Contents	The report has a well organized and suitably detailed TOC.
Introduction	The problem has been clearly and succinctly defined.
Summary	A very important part of the document. It presents the most important information contained in the report -- the critical design factors and the solutions adopted.
Tables, graphs, figures	Tables, graphs and figures are used appropriately and depict the data with clarity and precision.
Appendices	Important technical information and calculations have been included in appendices for reference, in a clear and intelligible manner.
Identification of critical factors	The critical factors that drive the aircraft design have been correctly identified.
Consideration of alternatives	Logical and practical alternative solutions have been considered prior to making decisions. The final solution adopted was the optimum, given the team's evaluation of the problem.
Unique or innovative solutions	Realistic, practical solutions to various problems have been implemented and function on the aircraft as intended.
Depth of technical analysis	The team has shown extra initiative in the quality and depth of the technical analysis supporting their design.

II ORAL PRESENTATION - 15 marks

Team		Scale - %					Weight	Score
		100	75	50	25	0		
Structure	Organization / logical order						1	
	Introduction						2	
	Discussion / alternatives						4	
	Describe chosen design						2	
	Summary / conclusions						2	
Presentation	Use of language						2	
	Use of illustrations						2	
Penalties								
TOTAL								
	Score =	**Total = sum of scores**					**Max = 15**	

Scale:	0%	Very Poor	No attempt was made
	25%	Poor	A token effort was made in this area
	50%	Average	Reasonable effort
	75%	Good	Valiant effort
	100%	Excellent	Professional quality, outstanding

Penalties may be imposed at the discretion of the Officials in respect of an Oral Presentation -- for example exceeding the time limit, or demonstration of an unacceptable degree of similarity between competing teams.

III FLYING - 60 marks

TEAM NAME				Page _____ of _____
FIT IN BOX	Official	Date	Time	Notes
Initial check				
After major repairs				

STABLE FLIGHT	Official	Date	Time	Notes
Initial check				
After major repairs				
Comments on payload:				

DETHERMALIZER	Official	Date	Time	Notes
Initial check				
After major repairs				

FLIGHT SCORING	* indicate and total the score for the 3 best flights in each period					
Date	Period (1, 2, 3)	Official	Launch at (hh:mm)	Payload (grams)	Endurance (seconds)	Score