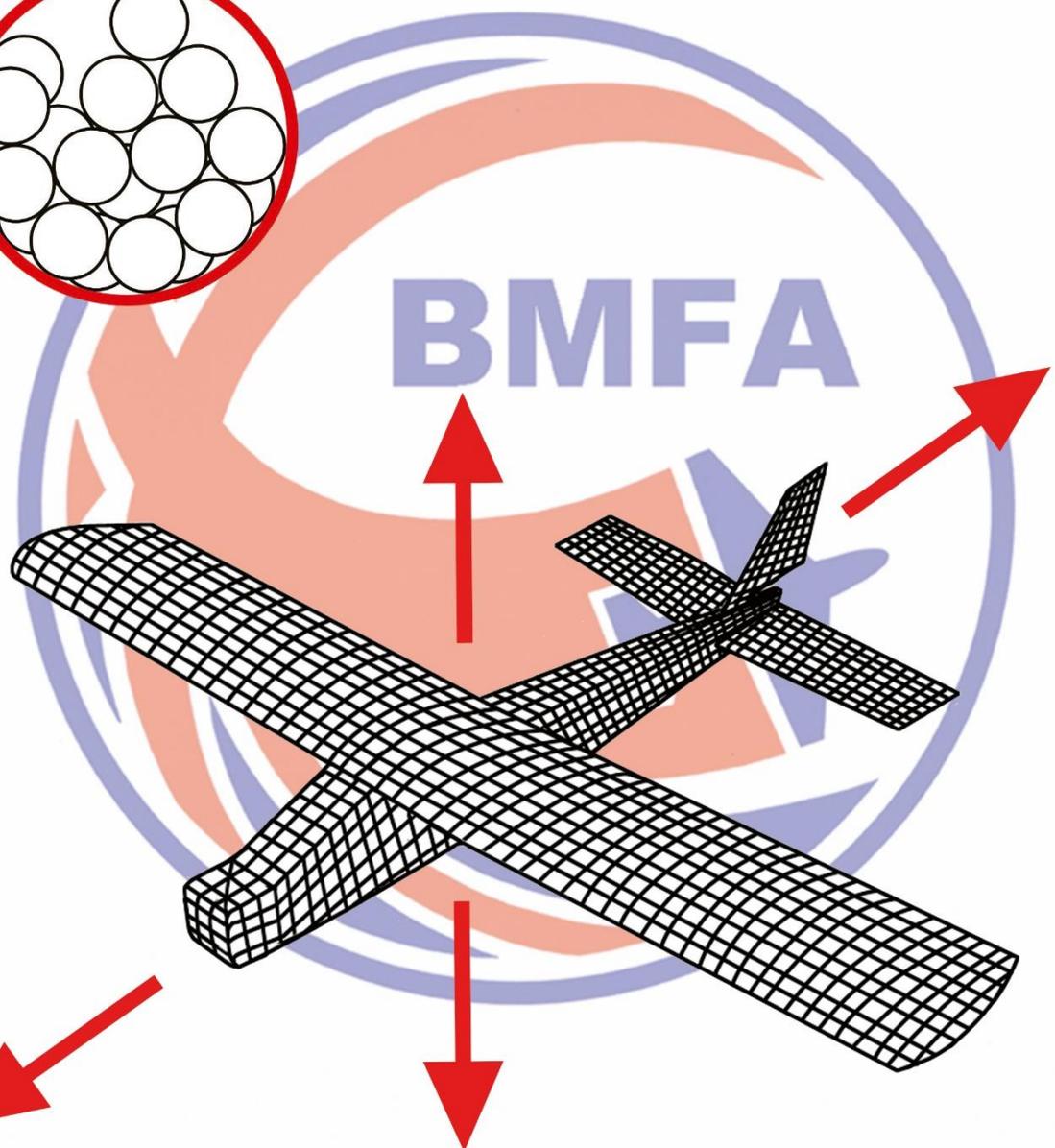
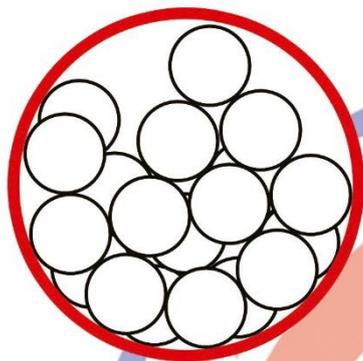


**British Model Flying Association**

**2022**

**Payload Challenge 4**

**Quantity**



**BMFA**



**Celebrating 100 years of British Model Flying**

**British Model Flying Association  
2022 University and Schools  
Payload Challenges**

**Dates Notice**

**14<sup>th</sup> & 15<sup>th</sup> June 2022**

**National Centre for Model Flying  
BMFA Buckminster  
Sewstern Lane  
Grantham  
Lincolnshire  
NG33 5RW**

**In Partnership with**



**ROYAL  
AERONAUTICAL  
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**BAE SYSTEMS**



**ROYAL  
AIR FORCE** **Engineering**

**ROYAL  
AIR FORCE**  
**model aircraft**

The British Model Flying Association invite your university or school to enter a team or teams in the

**2022**  
**Payload Challenge**  
**Challenge 4**  
**Quantity**

The information contained in this brochure provides a detailed overview of the 2022 Payload Challenge 4 as well as all information and forms for prospective entrants. We look forward to meeting your staff and students in 2022.

Should you require any assistance please contact  
the BMFA Challenge Co-ordinator.  
Manny Williamson  
(Address as on the entry form, final page)

**NOTE**

These competitions are supported by cash prizes, both for the organisation/department and the individual members of the winning team.

**New for 2022:**

All flight batteries supplied by competition organisers – ensure you read notes on specification and connectors.

## INTRODUCTION

The Payload Challenge 4 (quantity) has continually evolved to present fresh challenges to teams taking part in the competition.

This year's challenge utilises 150mm diameter polystyrene spheres as the payload to be transported, and having designed a suitable airframe for this challenging task, teams are required to submit a design report and drawings for their aircraft. In addition, they will conduct a 5 minute presentation to a panel of judges that addresses the key elements of the design, as well as outlining the thought processes and considerations involved.

For the flying element of the competition, teamwork, planning and a well-structured approach combined with a well designed and practical airframe will be key elements to success in this competition.

Please note that it is strongly recommended that the help of an experienced aero modeller is enlisted from the very start.

Local contacts are available from the BMFA office.

We look forward to receiving your team's entry for the 2022 Payload Challenge 4 (quantity).

### **In Partnership with the Royal Aeronautical Society**

- The Royal Aeronautical Society (RAeS) is pleased to be able to once again join the BMFA Payload Challenge event.
- The RAeS will provide Aerospace Professional support for judging and operation of the competition
- This support for the competition is part of the RAeS outreach programmes to schools, colleges and universities.
- The RAeS also provides career support to aspiring and established Aerospace Professionals and details can be found on its website at <https://www.aerosociety.com/careers-education/>



## **GENERAL CONTEST RULES**

### **CONDUCT**

- G 1.1 The maximum number in a team will be five students plus a manager and a pilot.
- G 1.2 For the flying element of the contest a pilot can be supplied by the contest organisers if required.
- G 1.3 It is important that all team members including the pilot attend the morning briefing.
- G 1.4 Teams should familiarise themselves with the contents of the competition rules brochures.
- G 1.5 Deliberate or repeated violation of safety rules may result in the team's expulsion from the competition.
- G 1.6 In the event of unsportsmanlike conduct, the team will receive a warning from the Competition Director. A second violation will result in expulsion of the team from the competition.
- G 1.7 The Competition Director reserves the right to ground any aircraft if in his opinion, or that of his appointee, the aircraft does not meet an appropriate standard of construction or radio installation.

### **AIRCRAFT CONFIGURATION**

- G 2.1 Aircraft must be of fixed wing configuration (no rotating lifting surfaces).
- G 2.2 The specified power system for each category must be used.
- G 2.3 Only the battery pack supplied by the organisers may be used for the flight competition.
- G 2.4 No modification to the motor is permitted.
- G 2.5 The specified "isolator" (fuse unit) must be fitted.
- G 2.6 The "isolator" must be mounted in such a location as to be readily accessible by team members and also easily visible to flightline marshals.
- G 2.7 The Isolator unit must be located a minimum of 100mm from the propeller arc and orientated so as to promote removal of the fuse predominantly away from the direction of the propeller arc (25 degree minimum).
- G 2.8 It is important that the unit is affixed to a suitably sturdy area of the airframe in order to prevent damage when fitting or removing the fuse.
- G 2.9 It is required that a tag or pennant is affixed to the fuse to aid removal and visibility.
- G 2.10 Only one flight battery may be used per flying round.

G 2.11 A propeller spinner or rounded safety nut must be fitted on forward facing motors.

G 2.12 The allocated team number must be displayed on the upper wing surface of the aircraft in characters a minimum of 100mm high in a contrasting colour.

## **RADIO RESTRICTIONS**

G 3.1 Radio control will be used to fly and manoeuvre the aircraft.

G 3.2 Equipment on the 2.4GHz band only.

G 3.3 A serviceable failsafe must be fitted that as a minimum returns the throttle to stop on loss or corruption of the radio signal.

G 3.4 Radio installations will be scrutinised by the organisers and must be deemed fit for the intended application.

G 3.5 Computer transmitters are permitted.

G 3.6 Aids to flight stabilisation such as gyros and auto level are permitted but pilot authority must be maintained at all times.

## **FLIGHT COMPETITION**

G 4.1 Time for trimming flights will not be available on the day of the competition.

G 4.2 The extent of the flying area will be announced during the morning briefing, any pilot flying within the briefed “no fly” areas will be directed to land immediately.

G 4.3 The pilot of the aircraft should perform appropriate pre flight checks.

G 4.4 The number of flight rounds will be announced at the morning briefing to reflect the expected weather conditions and number of entries.

G 4.5 The distances indicated on the flight plan sheet are for guidance purposes only, these will be set and announced at the morning briefing to reflect the prevailing wind conditions and location on the airfield.

G 4.6 Pilots will be individually briefed regarding flight pattern and dead airspace on the flight-line prior to their first flight of the competition.

G 4.7 The flight-line controller has overall responsibility and authority for all matters relating to flight safety.

G 4.8 Pilots must be prepared to “ditch” their aircraft on the order of the flight-line controller should he deem it necessary on safety grounds.

## **PROTESTS**

G 5.1 Any protest must be filed in writing to the Contest Director by the faculty advisor or team captain.

G 5.2 Any protest must be filed no more than 10 minutes after the Flight Competition is announced as being completed.

G 5.3 In order to have a protest considered a team must be willing to put up points specified in each Challenge, which may be forfeit, if their protest is not upheld.

G 5.4 The Contest Director may call upon a jury of interested parties to help with his decision.

G 5.5 The Contest Director carries the final vote in the event of a split decision.

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- Q 1 OBJECTIVES
- Q 2 CONTEST ELIGIBILITY
- Q 3 AIRCRAFT/POWER REQUIREMENTS
- Q 4 COMPETITION PROCEDURES
- Q 5 DESIGN COMPETITION
- Q 6 PRESENTATION
- Q 7 FLIGHT COMPETITION
- Q 8 SCORING
- Q 9 ENTRY DETAILS
- Q 10 PRIZE AWARD DETAILS
- Q 11 FLIGHT PATTERN
- Q 12 ENTRY FORM

### Competition resources supported by



<http://www.4-max.co.uk/bmfa-payload-challenge.html>

Visit their website to view materials for the 2022 Payload Challenges but it is important that you place your order either by telephone or email in order to receive the discounted payload challenge prices.

Quote **2022BMFA** for 10% discount on competition items.

Please note; the BMFA does not stock competition materials

## **Q 1 OBJECTIVES**

Q 1.1 Contestants are to research, design, build and fly an electric powered, radio controlled aircraft, to transport the greatest number of 150 +/- 10mm diameter polystyrene spheres of mass 35 +/- 5g around a predetermined course in the three 6 minute time slots utilising a standardised propulsion unit.

Q 1.2 Teams are required to submit a technical report outlining their aircraft's design and construction together with design drawings. Teams are then required to give a verbal presentation in front of a panel of judges on their aircraft and finally take part in a flight competition to demonstrate the performance of their aircraft.

Q 1.3 Competing aircraft are permitted to make any number of flights during the prescribed time period and competitors must arrive at a strategy that best utilises the characteristics of their design within the time available (i.e. the two extremes would be a very fast and agile aircraft that carries only a small number of payload items but may complete several cycles or a larger slow aircraft that will carry a larger number but may only complete one or two cycles).

Q 1.4 The winners are the team who achieve the highest aggregate score for all the parts of the competition.

## **Q 2 CONTEST ELIGIBILITY**

Q 2.1 The competition is open to students in full time/part time education or similar groups e.g. Air Cadets and apprentices.

## **Q 3 AIRCRAFT/POWER REQUIREMENTS**

Q 3.1 Only fixed wing designs will be permitted to enter the competition. There is no wingspan limit.

Q 3.2 The power system will comprise one 4-Max PO-3541-1070 motor and 4M-ESC50A speed controller and a 3 cell Lithium Polymer battery of 2200 Mah capacity (supplied by the competition organisers fully charged for each round).

Q 3.3 The motor may be fitted with reduction gearing.

Q 3.4 The aircraft undercarriage must be designed to operate off a range of runway surfaces including short grass.

Q 3.5 Only batteries supplied by the organisers may be used for competition flights. Batteries will be fitted with XT 60 connectors (negative to pointed end)

## **Q 4 COMPETITION PROCEDURES**

There will be three elements to the competition in which all participants are required to compete.

Q 4.1 The design element, will enable the contestants to present their designs and demonstrate their calculations to a panel of expert judges.

Q 4.2 The presentation, where students will be required to explain their design to a panel of judges

Q 4.3 The flight element, will determine which aircraft is able to transfer the greatest number of payload spheres from the “departure lounge” to the “arrivals gate” via the prescribed course in the fixed time period.

Q 4.4 Each team must display their designated entry reference on the wing of the aircraft in characters a minimum of 100mm high in a contrasting colour. Aircraft not fulfilling this requirement will not pass scrutineering and processing.

Q 4.5 A safety and airworthiness inspection will also be conducted to enable teams to address any item requiring attention before flight.

Correct Failsafe operation must also be demonstrated at this time so it is important that the transmitter is made available to the scrutineering team.

## **Q 5 DESIGN COMPETITION**

Q 5.1 DRAWINGS: Each team must submit detailed drawings for the aircraft which is to be flown. The drawings must contain fully dimensioned front, end, and plan elevations. These must all be drawn to scale and with the scale shown. Drawing files must be of sufficient resolution to permit all detail to be clearly noted. Materials and sizes are to be indicated. Detail drawings, which are deemed necessary to explain structure of the aircraft are also to be included.

**Each drawing sheet will include the name of the team and the designated reference number in the title box.**

**Teams must submit the drawing set by Email in PDF format only to the address supplied at the rear of this document.**

Q 5.2 The judges will evaluate the drawings based on a professional standard format. Areas of evaluation will include.

- Detail
- Completeness
- Explanation of structures
- Readability
- Graphical standards

Q 5.3 A maximum of three sheets of drawings is permitted.

The drawings will be worth **25 points**.

Q 5.4 REPORT: It is intended that the written report will be less academically rigorous when compared to Challenge 5. Each team must submit a report which outlines the design philosophy of the aircraft, team roles and responsibilities, choice of configuration, payload distribution, manufacturing techniques and any practical testing undertaken. No prediction of the total payload to be transported is required. Any original or innovative ideas should be described, together with the use of unique or advanced structural techniques and materials. The report is worth **25 points** and should comprise no more than six double-spaced, typewritten pages of A4 paper, including any appendices and diagrams (not

including the front cover sheet). Minimum type size to be 12 point. Where an institution enters more than one team, the designs, reports and drawings are to be produced by each team independently.

**Each page of the report will include the name of the team in the footer or header as well as the designated reference number** (supplied with confirmation of entry). If a report exceeds six pages, only the first six pages will be marked. As per the drawings, the report must be submitted in PDF format.

Q 5.5 Drawings and reports are to be submitted by Email to both judges at least 30 days prior to the start of the flight competition. Late submissions will be penalised and competitors are advised that, in these circumstances, the judges' comments may be less carefully considered. The organisers are not responsible for lost/misdirected drawings/reports, please ensure that you request an acknowledgement Email when you submit your team's information and do not assume that your Email has arrived if you do not receive this. Do not send reports to the contest director. Hard copy drawings can be returned on request.

Although normal course tuition and guidance is expected, the reports, drawings and the building of the aircraft are to be treated as though they are examination submissions and are to be the sole work of the students.

## **Q 6 PRESENTATION**

Q 6.1 PRESENTATION: Prior to the first competition flight, each team will present their aircraft design before a panel of professional engineers.

Q 6.2 Each team will be allocated five minutes in which to describe and promote their design, content falling outside of the allocated time will not be considered during marking.

Q 6.3 Visual aids will not be permitted, however teams may utilise material/test samples, aircraft cross section samples and replica components as part of the presentation to judges. The aircraft should be available for the presentation and a **10 point** penalty will be incurred if the complete aircraft does not feature as part of the presentation.

The presentation is worth **30 points**. Judging criteria for the presentation will include:

- Balance and continuity
- Articulation
- Technical highlights

Q 6.4 Subsequent to each team's presentation, aircraft details will be recorded.

**NOTE: Experience has shown that teams do not make the best use of the opportunity to gain the additional points that the presentation offers, remember, your teams presentation should aim for a professional standard and "sell" the benefits of your particular design to the maximum.**

**This competition is as much a test of your organisational skills as of your engineering flair. You may well have a world-beating design....on paper. Each year several teams fail to complete their projects by the date of the Flight Competition.**

## Q 7 THE FLIGHT COMPETITION

Q 7.1 The aircraft must be rendered “safe” on all occasions that it is handled by the team for the purpose of payload transfer, a team member must display the isolator/breaker for the benefit of the flight line marshals during loading and unloading.

Q 7.2 The payload may be carried on or in the airframe in whatever manner is deemed appropriate. Duplicate removable module(s) are **not** permitted and it is important that the payload is distributed and secured in such a manner that it cannot significantly alter the centre of gravity of the airframe in flight. It should be borne in mind that the payload will need to be transferred to the scoring receptacle in the shortest possible time in order to maximise the overall scoring opportunity.

Q 7.3 Any number of flights may be made during the allocated time slots.

Q 7.4 At the start of the time slot the aircraft should be without load, on being given the start signal the team must load the aircraft from the “out box” with an appropriate quantity of polystyrene spheres. The aircraft must then be carried to the take off line and set down facing predominantly into wind, at this time the power system can be rendered “live” by inserting the “isolator”.

Q 7.5 The aircraft must take off from a standing start (no pushing) utilising it’s own undercarriage.

Q 7.6 Take off must be achieved by pylon one whereupon a flag will be raised immediately the model has passed the pylon. The aircraft will then proceed to pylon two where the same process will apply. The aircraft is then flown on a path that most effectively lines up for a landing in the prescribed area.

Q 7.7 Should a successful take-off not be completed, teams may retrieve the model for further attempts without reloading and the payload may be reduced at this time if required.

Q 7.8 The aircraft must land in the designated area. The designated area will be defined at briefing). Only when the aircraft has come to a complete standstill, may a team member approach, disarm, then retrieve the aircraft and return it to the loading bay where the payload will be transferred to the “in box”. This rule will be strictly enforced in the interests of safety and fairness, teams should note that there are no limits on the number of functions utilised therefore a “braking system” (for example) could be considered as a compliant addition to the airframe.

Q 7.9 Further flights within the time slot will commence immediately with loading from the “out box” followed by a repeat of the previously outlined process.

Q 7.10 At the end of the time slot the “in box” will be closed and the contents checked and recorded by the CD or his appointee.

Q 7.11 No transfer of payload will take place after the end of the time slot has been reached.

Q 7.12 No transfer of payload may take place outside of the designated area (other than to reduce payload).

Q 7.13 The aircraft must finish the slot in an airworthy condition and with the original parts. The only exception being the propeller and undercarriage components.

Q 7.14 The aim is for each team to fly three, 6 minute slots, however, a final decision will be announced at the morning briefing to reflect the time available, the number of teams competing and the expected weather conditions.

Q 7.15 The distances indicated on the flight plan sheet are for guidance purposes only, these will be set and announced at the morning briefing to reflect the prevailing wind conditions and location on the airfield.

Q 7.16 Time for trimming flights will not be available on the day of the competition. Entrants should test fly their aircraft with a full load prior to the competition.

Q 7.17 For protest information see General Rules but in this category the team will need to put up 20 points.

## **Q 8 SCORING**

### **Penalty points are assessed as follows:**

- **2 points deducted for each day or part day late in delivery of plans or reports**
- **10 points deducted for no aircraft at presentation**
- **20 points deducted for unsuccessful protest**

The flight score will be normalised, **100 points** will be awarded to the team who transport the largest quantity of payload items across all three rounds and all other teams' scores will be calculated as a percentage of this figure.

**See scoring panel for further detail**

## Challenge 4: Quantity Scoring

### Report

Maximum six A4 sheets, double-spaced, PDF format.

| Category                          | Points Available | The judges would like to see:   |
|-----------------------------------|------------------|---|
| Design Philosophy of the aircraft | 5                | How the team approached the challenge. Include time and budget constraints  |
| Team roles and responsibilities   | 5                | Include management, technical and manufacturing roles.  |
| Choice of configuration           | 5                | A logical explanation of the aircraft concept, including the factors which influenced the final choice, such as payload considerations.             |
| Manufacturing techniques          | 5                | Any fabrication and assembly processes used. Include jigs and cutting templates if used, together with any novel build features.                    |
| Testing                           | 5                | Tests might include: Loading of sample joined pieces for bond strength tests, structural testing of wing, motor thrust rig, pit-stop training etc.. |
| <b>Total Max Points</b>           | <b>25</b>        |   |

### Drawings

Maximum 3 sheets PDF Format

| Category                  | Points Available | The judges would like to see:  |
|---------------------------|------------------|--|
| Detail                    | 5                | 3 clear views of plan, side and front elevation. Include template outlines of ribs, frames etc. Include a wing section to permit some structural assessment.               |
| Completeness              | 5                | Include dimensions for span, length, CG location. Indicate extent of control surfaces, payload provision and R/C gear location. Use a bill of materials or table of parts. |
| Explanation of structures | 5                | Use section views to reveal crucial internal features. Avoid unnecessary isometric views without dimensions or notes attached. Show payload provision and access features. |
| Readability               | 5                | Logical progression of explanatory notes. Arrows, labels and part IDs to be unambiguous. Where section arrows are used, indicate sheet and grid ref. to locate views.      |
| Graphical standards       | 5                | Neat outlines, clear text, fine leader lines and uncluttered dimensions. Standardised bordered sheet with reference grid and title block.                                  |
| <b>Total Max Points</b>   | <b>25</b>        |  |

## Presentation (5 minutes)

| Category                | Points Available | The judges would like to know:  |
|-------------------------|------------------|---|
| Balance and Continuity  | 10               | Each team is to describe the design of their aircraft. Include any interesting features, especially payload loading/unloading. Avoid copying content of your report and consider this a sales pitch to promote your design. We like to see contributions from several team members. |
| Articulation            | 10               |   |
| Technical Highlights    | 10               |   |
| <b>Total Max Points</b> | <b>30</b>        |   |

## Flight Competition

|               | Circuit 1  | Circuit 2  | Circuit n  | End of allocated round time  | Flight Score  |
|---------------|--|--|--|--|---|
| Round 1       | Round time starts, aircraft is loaded with 150mm spheres from out-box and takes off. | Aircraft is loaded with fresh spheres from the out-box, performs another flight and unloads to in-box. | Aircraft is loaded with fresh spheres from the out-box, performs another flight and unloads to in-box. | Land safely for nth time, unload last spheres to in-box before round ends.                                 | Count the total number of spheres successfully carried within the round |
| Round 2       |  | 6 minutes round time available   |  |  | Count the total number of spheres successfully carried within the round |
| Round 3       |  | 6 minutes round time available   |  |  | Count the total number of spheres successfully carried within the round |
| Example Round | Aircraft is loaded with 3 spheres and takes off                                      | Aircraft is loaded with 3 more spheres, successfully delivering all to the inbox.                      | 2 more circuits are performed with 2 spheres delivered each flight.                                    | Aircraft is airborne with 2 more spheres at end of round time. These are not included in the flight score. | Flight score = <b>10 spheres</b><br><b>3 + 3 + 2 + 2</b>                |

## Normalisation of flight scores

Upon completion of all three rounds, the number of spheres are added together. The team with the highest aggregate score is awarded **100** points. All other scores are calculated as a percentage of this figure.

## Summary

|                         |                                 |                          |
|-------------------------|---------------------------------|--------------------------|
| Report                  | Max possible score              | <b>25 points</b>         |
| Drawings                | Max possible score              | <b>25 points</b>         |
| Presentation            | Max possible score              | <b>30 points</b>         |
| Normalised flight score | Highest aggregate flight score. | <b>100 Points</b>        |
| Penalty 1               | Late Report and/or drawings     | <b>-2 points per day</b> |
| Penalty 2               | No aircraft at presentation     | <b>-10 points</b>        |
| Penalty 3               | Protest not upheld              | <b>-20 points</b>        |

## Q 9 ENTRY

PLEASE SEND YOUR COMPLETED ENTRY FORMS TO THE CHALLENGE CO-ORDINATOR AT:

The British Model Flying Association  
Challenge Co-ordinator  
Chacksfield House  
31 St Andrews Road  
Leicester  
LE2 8RE

Or by email marked for the attention of the Development Officer (Manny Williamson) at [admin@bmfa.org](mailto:admin@bmfa.org)

To facilitate planning, we must receive, by 1<sup>st</sup> April 2022, a formal notification of your intent to enter the 2022 competition and also payment of the appropriate entry fee.

## REPORTS AND DRAWINGS

All reports and drawings must be submitted at least 30 days prior to the day of the flying competition, late submission will be penalised as described previously. Material should be sent by email to both judges:

[Andrew.white@baesystems.com](mailto:Andrew.white@baesystems.com) and [Nigel.revill@baesystems.com](mailto:Nigel.revill@baesystems.com)

NOTE: On receipt of your completed entry form you will receive a confirmation and also your unique team designation reference; this reference must be quoted in **all** correspondence.

## Q 10 PRIZE AND AWARD DETAILS

### 1<sup>st</sup> Place

The Integro Challenge Trophy\*

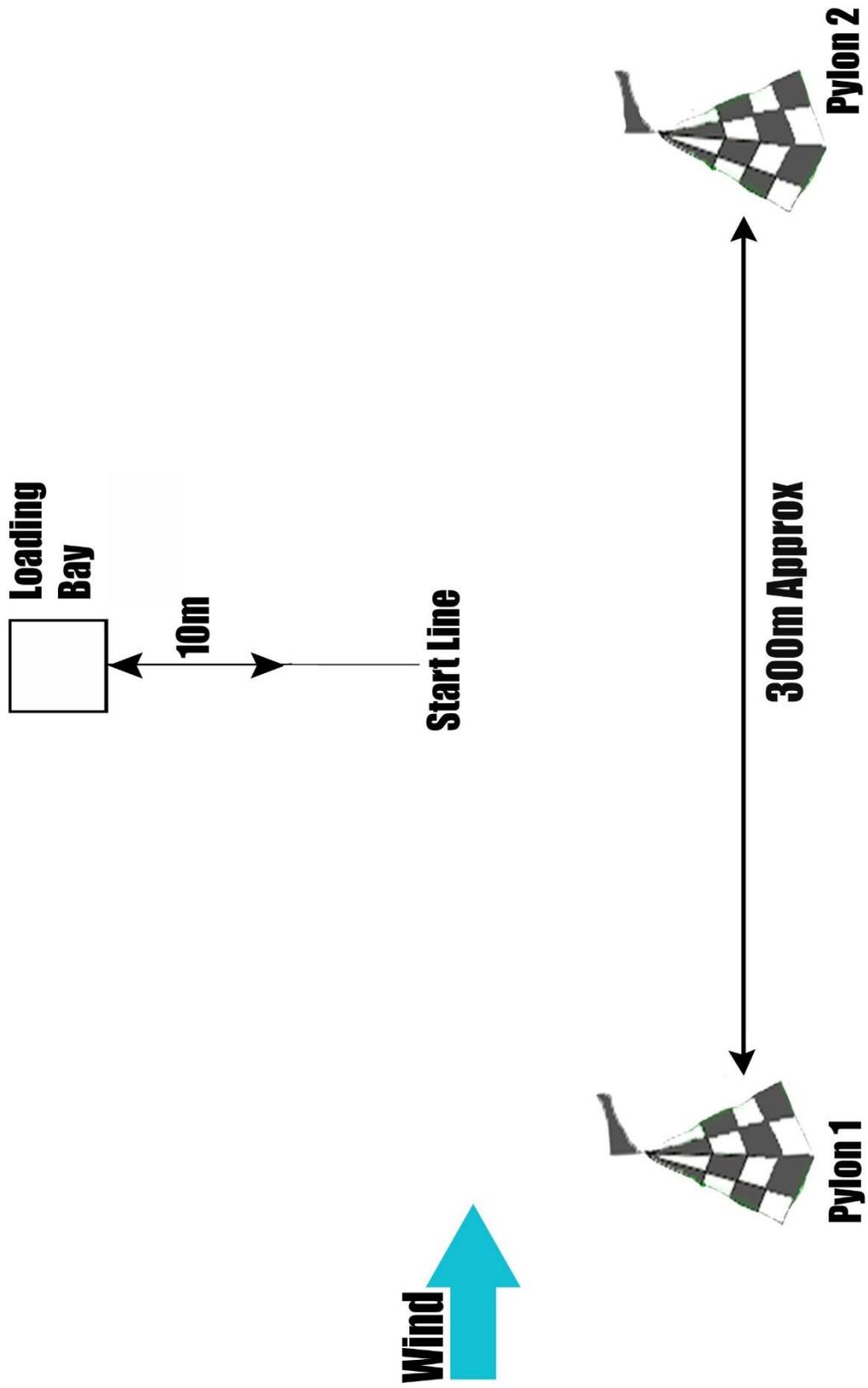
£150.00 Cash prize, paid to university department or school.

£50.00 Cash prize, paid individually to each team member (up to a limit of five persons).

**Certificates will be awarded to all competitors.**

\* Note: the Integro Trophy is presented to the winning team on an annual basis and remains the property of the British Model Flying Association. The trophy must be returned 28 days prior to the competition of the following year in order that it is available to present at the event.

**Flight Pattern Subject To Wind Direction**



# Entry form for 2022

## Payload Challenge 4

### Quantity

**Note: Please copy this form and complete one form per team**

**Forms to be received by 1<sup>st</sup> April 2022**

**Name of University, School, youth group or organisation:**

\_\_\_\_\_

**Name of Tutor/Teacher responsible for entry:** \_\_\_\_\_

**Team Name:** \_\_\_\_\_

**Names of 5 Team Members:**

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

**Pilot:** \_\_\_\_\_

**Name and Address of Team Manager**

**Name:** \_\_\_\_\_

**Address:** \_\_\_\_\_

\_\_\_\_\_

**Contact Number:** \_\_\_\_\_

**Email:** \_\_\_\_\_

All correspondence relating to the 2022 Challenge will be conducted through the addresses and numbers given on this form

Do you require technical assistance from local aeromodellers? YES / NO

Do you require a pilot? YES / NO

Please note a fee of £125.00 is payable per Team entered (non refundable).

Cheque to be made payable to BMFA or alternatively to pay by credit/debit card please contact the office.

Cheque enclosed

British Model Flying Association  
Challenge Co-Ordinator  
Chacksfield House  
31 St Andrew's Road  
Leicester  
LE2 8RE

Telephone: 0116 2440028

Please note on receipt of completed Entry Form and payment each team will be issued with a unique reference number which must be quoted in all correspondence including submissions to the judges and also displayed on each aircraft as detailed in the Rules Brochure.

Office Use Only

Payment Received:  Date: \_\_\_\_\_ Signature: \_\_\_\_\_

Reference Number: \_\_\_\_\_