



The China International Aeromodelling Design Challenge

PAYLOAD CHALLENGE ■ BRUCE CORFE ■



Frustrated by the lack of competitions of a payload challenge nature on British soil recently courtesy of Covid, Bruce Corfe looks at how his favourite event is conducted on the other side of the world.

Your scribe was disappointed to learn that this year's BMFA Challenge competition was cancelled for the second year in a row (for obvious reasons) – disappointed because I've enjoyed attending and reviewing the meeting several times in the recent past, both at Buckminster and previously at Elvington, near York.

Indeed the last time the event was held pre-Covid I was

delighted to learn that Ollie Harris and the University of South Wales team named their entry 'The Spruce Bruce' in my honour – a rather portly design which flew well, luckily!

BRITISH MATCH FOR ASIANS!

Similar challenges take place around the globe in normal years. Thanks to my Chinese friend, Ruichen He, whom I met at Buckminster, I've been getting

updates on their annual version of the Challenge in China.

Ruichen and his team from Beijing University of Aeronautics and Astronautics – BUAA (subsequently renamed 'Beihang University' for reasons unexplained, but retaining the BUAA initials) did exceptionally well at the UK meeting when we met – we then exchanged photos and emails and in fact he and his girlfriend visited my wife and I in Perth, Western Australia, on their recent tour of Oz. The joke amongst the hugely successful Chinese teams at Buckminster was that BMFA stood for 'British Match for Asians'...

The Chinese contest is called the China Aeromodelling Design Challenge, or CADC. Honestly, it's on another level – it's off the scale. Each year the competition attracts students from more than 100 universities in China (103 universities and 1817 student participants in 2019),

including many military schools, so it's the top aero-modelling event in China. Every year the CADC takes place in a different city, usually on a university campus.

I've been looking through Ruichen's team's photos from the last times the event was held, pre-Covid, and I thought there might be interest amongst modellers here to see what happens on the other side of the world (and why they're always so successful when they come over here!).

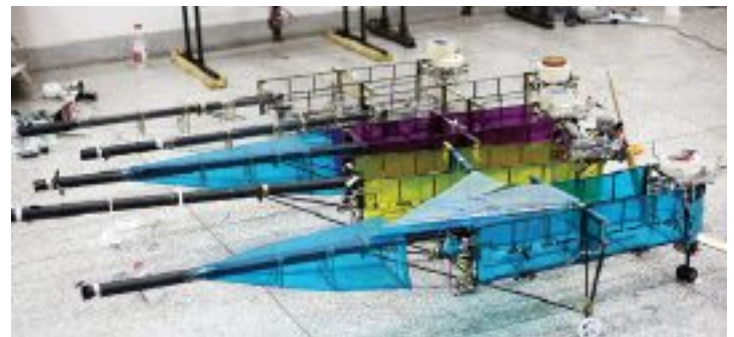
This time we're going to look at the construction of some of these highly specialised models and the pre-contest preparation taken by the enthusiastic (fanatical?) young engineers who build and fly them – the photos were taken by members of the BUAA CADC Team, who are those wearing shirts with the two characters '北航' marked on their backs.



Frantic preparations by the BUAA Team in a classroom at the host venue, in the early hours judging by the windows.



More intense activity. Note 4 differently-coloured wing sets at the rear.



Four BUAA water-drop fuselages being reassembled and in some case, covered, pre-competition.



Need wings? We got 'em – BUAA's Solar Aircraft challenge wings and canard foreplanes – white undersides of the wing-top solar panels visible.



You can never have too many props! These are wooden JXF brand – another popular make is SAIL.



Busy LiPo charging station.

HERE ARE SOME COMMENTS FROM RUICHEN (WHOSE COMMAND OF ENGLISH IS EXCELLENT):

"I will give you a brief introduction about the CADC and our team. The rules of the competition for now are slightly

different from those of 2017 and earlier. Up to 2017, the '3kg Program' is the highlight and the most important part of CADC.

In this challenge, the empty weight of the aircraft to be designed (including engine) shall not exceed 3kg, the size of the

I.C. engine shall not exceed 3.5cc with gearbox, and the competing aircraft should carry water bags as payload, to fly over 18 meters then drop them in a targeting range. There are 3 zones in the range, with diameters of 8m, 16m and 40m. Each are assigned with different credits.

Each crew can have 5 minutes to prove their skill, within the timeslot they fly as many times as they can. The more weight dropped in the range in the 5 minutes, the more credits a team could earn. (The highest weight an aircraft could carry once in record was 18kg, as I remember).

Solar Aircraft is another challenge, the goal is to design a solar aircraft which has limited solar cells, limited weight of 3kg, no battery power, and should carry as much weight as possible to fly as long as possible.

Also, there are many other challenges like 'Helicopter Rescue', the 'eVTOL' challenge, the 'Reconnaissance', the 'Rocket', etc!"

EVOLUTION OF THE CHALLENGES:

The CADC challenges have evolved greatly over time. For instance, in 2014, the three challenges were:



Wheel-wrangler giving the universal Asian to-camera victory sign!



The size of the tail-feathers gives an idea of the scale of BUAA's entries.



BUAA students work on their Helicopter Rescue Challenge model, building a robot to be carried by a helicopter (tail rotor on far left).



Some construction detail images follow – check out the lightweight construction (and sturdy L.E. box) here, using carbon, light transparent film – and lots of air!



Maximum use of lightening holes in this beautifully designed & constructed wing.



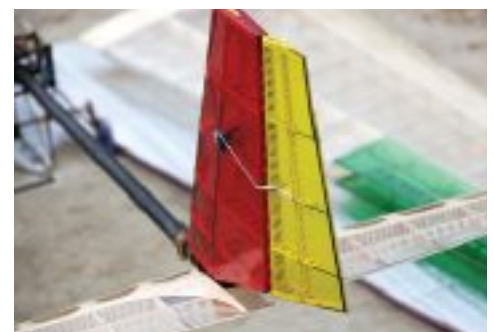
Water 'bombs' are constructed from plastic bags bound with tape (I bet that's easier said than done).



Another team's entry awaiting its engine – note all-carbon fuselage.



The same model's carbon bomb-rack, steerable nose wheel and rubber-sprung rear wheels.



The model also has a lightweight all-moving tailplane.



BUAA's massive twin fin, 2 motor canard Solar Aircraft challenge model is lifted onto its take-off dolly – main outer panels not yet added to the 6 metre wing! 88 Sol.



Another twin geared-electric model, with an enormous dolly!



Hurrah! One of 'our' BUAA team's water-drop I.C. models out on the apron. Note thickness and light construction of the wing.



Lightweight Solar Aircraft challenge wing with blue solar panels and semi-geodetic rib work - (Maximum payload/empty weight) x flight duration = final score.



Beautifully-constructed craft with OS R21 Shimo buggy motor, scratch-built gearbox, tuned pipe and huge Sail prop (possibly Hebei Institute of Technology).



Xiamen University Team ready for the off in worsening weather. Xiamen is one of China's top universities.



Colourful entries in the Reconnaissance Challenge and Glider Challenge.



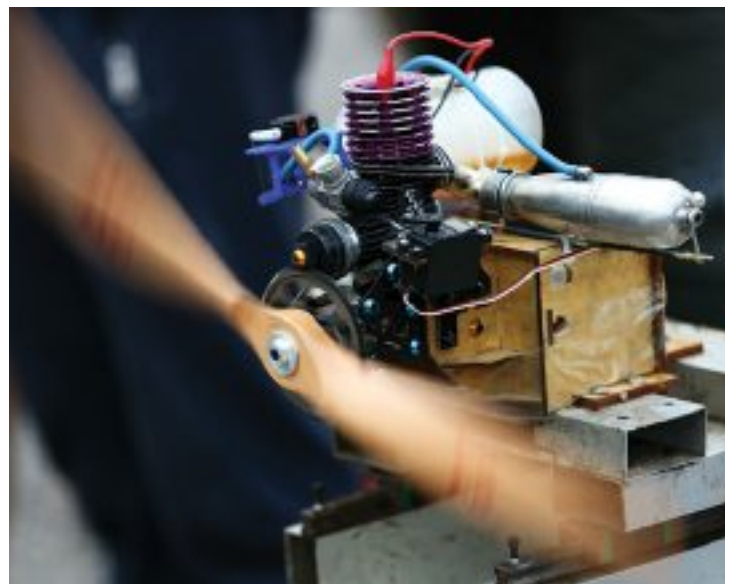
Engine removed showing carbon & alloy gearbox construction details.

1. VTOL Air Cargo Race - for fixed-wing VTOL aircraft, max weight 500g with batteries, the winner being the team which drops the greatest number of table-tennis balls on the target area within a certain time.
2. Low Altitude Reconnaissance - basically, a fixed-wing drone which fits in a specific-sized box and can recognise and identify objects in a specified area.
3. Air Cargo Drop Challenge - 3-cell electric models, 25A current-limited, max. 800g empty, transport box of prescribed limits, with a maximum 40m take-off run, dropping a payload of plastic bags of water on a specific

target area - marks for max. payload & accuracy.

The following classes were published for the 2020 Challenge, which didn't take place. (Any military application is purely coincidental!)

1. Limited-time airdrop
2. Simulated search and rescue
3. Solar-powered aircraft
4. Vertical take-off and landing
5. Ground reconnaissance and strike
6. Multi-stage model rocket launch & load recovery
7. Model water rocket boost spacecraft
8. Limited-range load airdrop
9. Micro folding aircraft



Novarossi Mantra-H 3.5cc buggy motor with intake restrictor plus similar gearbox, on the test bench.

As most of my information about the CADC is in the form of photos, I'll keep the text here brief and give editor Pete and the designers plenty of space for the images.

The images here focus largely on preparation for the '3kg Program' or challenge, which is probably closest in concept to the UK's BMFA 'Challenge 5 - Weight' (formerly Challenge 3 - over here, teams must carry as great a number of

tennis balls as possible) which is our 'Formula One' event - although I do love the 'water bomb' aspect of the Chinese challenge!

The water-bag 'bombs' are teams' own designs, the referees measure the weight and integrity of each. Most teams use plastic bags and reinforce them with tape.

The teams are free to select any I.C. motor and gearbox within the rules. Most teams

have adopted engines from Novarossi or O.S. After much zooming-in on the photos, I have discovered that two of the motors used were the Novarossi Mantra-H and the OS R21 Shimo, so one Italian and one Japanese brand (although both possibly manufactured in China!?).

These motors are top-end 1/8th off-road buggy engines (the huge finned heat sinks were my first clue), costing up to £300 here in the UK. Specs include displacement of 3.5cc/ .21cu.in, rear exhaust, ceramic bearings, 4 or more ports and revs up to 45,000 rpm (yes I typed that correctly!) putting out just under 3hp. on 25% nitro fuel. The teams use reduction gearboxes in a variety of styles and generally, large wooden props.

CONCLUSIONS:

I hope readers will be interested in (and perhaps inspired by) the sheer ingenuity and hard graft which these Chinese youngsters apply to the contest and its models, and can see why they perform so well when they come to the UK.

Incidentally, the CADC is open to all-comers - it would be

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awesome to see a UK team represented there. With the Ed's permission (granted - Ed.)we will look at the flying elements of the CADC in a future issue. Many thanks to Ruichen He and Dr Song Lei for their help with this article.

LINKS:

There is a brilliant paper on BUAA's 2018 CADC Airdrop and Solar Aircraft projects, by Li Jinjie - Undergraduate Student at Beihang University, at: https://lijinjie.top/Projects/Solar_Aircraft/



Another side-mounted OS R21 Shimo engine with complex gearbox construction, apparently incorporating an electric starter motor at lower right of photo.



The heavens have opened as the BUAA team make final preparations on 'Red Tail 1'!



BUAA 'Yellow Tail 1' is lifted onto the apron.



Both of the above BUAA models ready for the off, with big supply of enormous water bombs.



Last-minute adjustments - note BUAA's streamlined wing root fairings and double bomb-bay.



Now this is what we want to see at Buckminster! Pre-contest team calisthenics (or prayers?) on the apron!



Completely different - Ollie Harris's 'Spruce Bruce' poly ball carrier at Buckminster in 2019...!