

# IMO 2013 - Deputy Leader Report

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## Abstract

This is a report detailing the events of the 54th International Mathematical Olympiad, held in Santa Marta, Colombia, July 18–28, from the point of view of the UK team. This diary originally appeared roughly real time on the author's blog<sup>1</sup>. The original comes with a longer introduction and pictures.

## Sunday 14th July

I spend the morning packing up my room as I am moving to a new flat pretty much directly after this trip. Everything seems a lot clearer after sorting out the IMO team uniform which had arrived just in time and left my floor essentially invisible under a sea of boxes. The mini-crisis wherein they were all delivered without my knowledge to the Worcester College kitchens seems but a distant memory...

We are flying at a painfully early hour tomorrow morning, so it makes sense to spend the night at an airport hotel. Courtesy of the satnav, I learn the hard way that there are three Holiday Inns at Heathrow. Geoff, Bev and I are the first to arrive, and wait for the students, two of whom are arriving directly from Copenhagen, bearing prizes and stories from the analogous physics competition just finished there. Parents are reassured that the occasional email and postcard will be sent and we retire in preparation for tomorrow's Odyssey.

## Monday 15th July

Up at 4.30am for the first leg over to Madrid. With time for little other than a quick coffee, straight onto the transatlantic flight to Bogotá. The ten hours afford plenty of time to catch up on reading some papers. Also enjoy the chance to spend several hours diving into *Love in the Time of Cholera*. I figured that this was almost certainly a once-in-a-lifetime opportunity to explore a Colombian novelist while in Colombia. So far, so good.

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<sup>1</sup><http://eventuallyalmosteverywhere.wordpress.com>

We learn courtesy of Iberia that tuna, peach and olives do not make a good sandwich combination, and wonder whether they will be able to resist the temptation to follow every announcement with a synthesised rendition of the opening bars of the *Concierto de Aranjuez*. A slight delay changing at Bogotá airport allows sufficient time for extra sushi and further progress through the example sheet solutions I've offered to L<sup>A</sup>T<sub>E</sub>X before the short hop north to Santa Marta. Gabriel's cynicism about the fate of our luggage turns out to be unfounded, but the two panama hats packed in my suitcase have not enjoyed the trip at all. The Santorini Hotel seems ill-prepared for a group arrival at 10.30pm, but eventually we obtain keys and pay. Shortly afterwards, we are able to unpay one of the bills that they have charged us twice within the space of five minutes. With everyone very grateful for the violent air conditioning, we head for much overdue sleep.

## Tuesday 16th July

Up at dawn from the jetlag, but a useful moment to sort out the details for the first practice exam. This pre-IMO camp is a joint venture with the Australian team, and both sets of students are sitting an IMO style exam each morning. The villa we are occupying is somewhat short of table space, but the three UK students perched on the kitchen bar with their scripts claim that it is fine. If IMO 2008 is anything to go by, where the desks for the competition were so steeply sloped that pens became more valuable as paperweights than as writing equipment, this might be useful practice.

While the students are getting on with the festivities, Bev and I explore various local food options. I also explore the beach, though the humidity is rather cloying in the middle of the day. The UK team make confident noises about the exam, so I hope that marking the Q2 geometry won't be too traumatic. Some complicated diagram dependencies render this hope in vain, but we finish up in time for a quick debrief before dinner. Meanwhile, the team have learned the hard way that Colombian plumbing does not hugely appreciate toilet paper. . .

## Wednesday 17th July

I would normally struggle rather badly to find the motivation to go for a 7am run, but with a mile or so of relatively quiet beach on offer, it suddenly becomes a much more attractive proposition. As I return to the Santorini resort, the first waves of peddlers are arriving. One or two make a token attempt to sell me sunglasses, and a nice lady asks me how I got a particularly purple bruise, though I figure my Spanish is not sufficient to explain the idea of cricket right now.

Geoff bids us farewell and heads off to join the other team leaders at a top-secret location

where they will begin the process of setting the paper. In theory it's top-secret; in practice, it must be Barranquilla, the next city down the coast. The students power through another exam all morning, and resist the temptation to make anything too complicated, so marking everything is pleasingly straightforward. Our stroll to dinner is accompanied by a small posse of feral dogs. I am reminded of the health guidance for this part of the world: "rabies is relatively low-risk, except for children, who are more likely to allow themselves to be licked in the face." The team, for now, resist this temptation.

### **Thursday 18th July**

The third practice exam again proceeds smoothly. The first problem is a nice exercise by John Conway, classifying sets of points which obey some intersection property. There were various ways to misread the problem, of which some students took full advantage, and an almost limitless number of ways to classify the satisfactory configurations. As a result the marking, which I chose to do outside, took ages, though at least I had the company of a few passing green lizards and a brief visit from a sea eagle.

The resort where we are staying, and where the IMO itself will be held, is actually about 10km outside Santa Marta itself, so we decide to venture in to explore the town once marking is complete. The historical centre, though modelled on a grid, is very Mediterranean, with narrow streets wending their way underneath exposed municipal wiring down to the seafront. We pause outside the Cathedral, where Mass is just starting. The dry heat clearly not enough to discourage a very full and colourful set of vestments.

On the way down to the sea we pass a park featuring yet another statue of the most famous man to live (and in fact die) in Santa Marta. Our guide Maria looks horrified as one of the students asks "Simón Who?" Dinner ends up al fresco, where we are treated to the accordion playing and fire-juggling in the town square. How does some one take up fire-juggling one wonders? Are there beginner kits with just lightbulbs on the end? Very few of the party receive the meal they think they ordered, but all are satisfied nonetheless. The convoy of taxis departs into the night. I am in the second one and it is clear that the driver has no idea where he is going, though his dedication to staying within sight of his leader is admirable if occasionally terrifying.

### **Friday 19th July**

To mix things up, today each team has set an IMO-style paper for the other to attempt. The UK team then has to mark the Australian scripts during the afternoon and vice versa, before co-ordinating the results with Ivan the Australian deputy leader and myself. It's always a profitable exercise to have to struggle with poorly worded solutions as perhaps

it will encourage everyone to avoid such things in the actual exam. Questions which fall into the realm of the combinatorial essay are always particularly at risk of large blocks of waffling prose, and each Q2 produces exactly that. Hopefully the students found the exercise useful as well as time-consuming.

Meanwhile, it seems that the UKMT-branded frisbees we ordered to distribute as gifts at the IMO have been held up somewhere in the intricacies of Colombian customs. Initial attempts to speak on the phone are hindered by my non-existent Spanish, and even an attempt to spell out my email address is fraught with the challenges of differing vowel pronunciations. I fear we may have to resign ourselves to being the stingy delegation at this competition...

I take advantage of a relatively free afternoon to sample the resort's various pools and catch up on what's been happening in the cricket. Our own version of the Ashes is taking place tomorrow, so hopefully the demolition happening at Lord's is a good omen. Geoff and his brother are attempting to get the hashtag #otherashes trending. So far we have one tweet (by me) and a mention in the Guardian cricket feed. From tiny acorns.

## **Saturday 20th July**

And so to the final practice exam of this pre-IMO camp, the Mathematical Ashes. I was a student in 2008 for the inaugural competition, the only time the UK has lost, and so in keeping with the cricket tradition the ceremonial funeral urn is filled with the ashes of UK mathematics, including a geometry question in my handwriting. (In fact, the pyre formed during an excursion after the IMO in Madrid got a bit out hand, and so it probably contains a comparable amount of Australian material.)

As for the other exams, we are using questions from last year's IMO shortlist; problems that were considered for inclusion by the jury, but not selected. The first two chosen are at the easier end of the IMO difficulty spectrum, while the third is really very awkward indeed. Post-exam, the teams compare notes and it seems that it will be tight, so Ivan and I divide up the questions, devise brief mark schemes and get going. Three hours later we feel happy with our conclusion: UNK 82, AUS 81. In reality, by far the most pleasing aspect is that both teams have demolished the two easier questions with such aplomb. This bodes very well for the IMO itself next week.

A wager is placed that less than 10 minutes will elapse between emailing Joseph Myers, custodian of the IMO Register and the BMOS website, and the results appearing on the latter. The placer of this wager turns out to be rather wise. We await a flood of hits on the OtherAshes blog. Meanwhile, we pay our final visit to the Santorini resort restaurant, who have accommodated our various dietary specifications and comical Spanish with élan. I order at random from the fish and seafood section and end up with a steak topped with

guacamole. Definitely not complaining. Everyone heads back feeling excited for the start of the main event tomorrow.

## **Sunday 21st July**

It turns out that the main entrance to the Hotel Irotama, the resort hosting the olympiad, is less than 100m from the entrance to the villas where we've been staying. The jury remains out on whether that makes us the first team to arrive at an IMO on foot, not least because we are joined for this short but significant journey by the Australian and Israeli teams.

It's another sticky and unpleasant day, but initial impressions are very favourable. The team have a pair of bungalows with dried leaves for roofs. Lunch is available from beside the beach at a selection of restaurants, which have all been uniformised for the week. In any case, it is a pleasant reversal of the usual situation for the food to be high in quality and low in queueing time.

The UK students are immediately keen to meet other teams, starting with some of English-speaking countries, and moving on to the United States. The non-verbal school of interaction continues as a massive multi-national cross between water polo and rugby emerges in the pool, visible from my 11th floor balcony. The views across the bay as the sun sets are spectacular, even if the wind and the low railings do make me question the wisdom of the hammock strings above the jacuzzi?

## **Monday 22nd July**

Today's main event is the Opening Ceremony, which is held in Barranquilla, near where the team leaders are currently based. The boards in the lobby advertise a sensible plan partitioning the teams into equal-sized classes alphabetically. We are bound for bus 20 with the USA and the enigmatic "others", though disaster strikes when it transpires the buses provided are not equal in size. An appropriately weighted partition emerges organically, and we are on the move. The two-hour drive offers some views of the closest Colombia's Caribbean can get to a rugged coastline and bustling towns provide a welcome contrast to the constant glossiness of the resorts.

The Opening Ceremony features the usual sequence of speeches, children's choirs, and the procession of the teams. Barranquilla is Colombia's fourth-largest city, and the economic centre of this region. The carnival held there annually is the most famous in South America outside of Rio. Even though that was six months ago, it is a nice touch to invite a selection of the dancers, acrobats and musicians to accompany each of the teams round the sports hall where the ceremony is taking place.

Other teams have extravagant rituals planned for their brief moment of limelight, but the UK students opt for a more reserved approach, apart from choosing at the last minute to hoist Sahl onto various shoulders. Having safely dismounted near the end of their circuit, they receive a bold thumbs-up from Geoff who is sitting in the leaders' area, segregated on the other side of the hall. Whether this is a token of encouragement for tomorrow's paper, or a show of delight in the minimalist choreography remains to be seen.

The festivities drag on a bit longer than planned, and after four hours hunger levels are becoming fractious. I don't really want to know how long the turkey sandwiches had been slow-cooking in the sun, but for once it is convenient to have a solid component of vegetarians in the UK team. After an entire day of sitting around, I propose a brisk walk along the shore after dinner. We are prevented from leaving the Irotama's portion of beach by a member of hotel security. I have a Deputy Leader's badge. He has a gun. We make do with the view of the stars and the flotilla of ships lining up for the Panama Canal.

## **Tuesday 23rd July**

It's the first day of the competition and understandably the team are a bit nervous at breakfast. We follow the organisers' instructions to the letter, and arrive almost an hour early at the exam hall, located at a similar hotel further down the road. After a final check of compasses and so forth, the team sally forth to their respective rooms, and the deputies return to the hotel and take a quick swim while waiting for some copies of the paper to materialise.

As the delay grows, the number of deputies waiting outside the office reaches what feels like a critical mass. It will transpire that some members of the Syrian team who had been delayed by visa complications have just arrived, and arrangements are being made for them to sit the paper before it is generally released. Ivan briefly astonishes onlookers by quoting instantly a solution to Q2, before revealing that it is in fact his question. We have about an hour to think about the problems before meeting the students.

The UK team are generally pleased with the paper, with five students claiming the first two questions, and some tentative offerings on the final question. We have a succession of more formal individual debriefs while walking back to the Irotama down the beach. Some of their arguments for Q1 sound rather more complicated than required, but hopefully it will all make sense when Geoff and I get to see the scripts. In the meanwhile, the UK students head to the pool, trying as much as possible to avoid comparisons with other teams and other non-helpful forms of post-mortem.

## Wednesday 24th July

We allow ourselves the luxury of an extra 20 minutes at breakfast but along with many teams are still absurdly early for the second day's exam. Today's security is much tighter, and the deputies are not allowed into the conference building, so content ourselves with exchanging the national olympiad booklets and competing for the few patches of shade available from the baking morning sun.

Back at the resort, there is again no sign of the problems, so I use the freshly-unlocked Irotama wifi to sort out a very last-minute change of tenancy agreement and speak further with Colombian customs. Apparently the tax on a case of frisbees is 150,000 Pesos (a slightly less impressive sounding £50). My expectations remain low. It will transpire, however, that missing the official deputies excursion might have been a good idea. Reports are floating around of a 2 hour video and a bus tour with no actual stops.

After the paper we meet the team, who all seem very upbeat. Everyone claims solutions to Qs 4 and 5, with all but Warren resisting the temptation to deploy some form of co-ordinate method on the geometry. Andrew also claims Q6, so overall everyone is pleased, and looking forward to an afternoon free to enjoy all that's on offer at the competition now that the pressure is off.

Geoff joins us in time for dinner bearing the first day's examination scripts and plenty of gossip about activities at the leaders' site. However, our task for the evening is not a social one. The second day's scripts arrive at about 8pm, and then we retire to devise our plan of attack. It makes sense to tackle three questions each, so I have a look through the Q5 scripts, and all seems fine, with the Q2 and Q6 answers to be addressed tomorrow. By comparison with the fairly reliable grapevine, it does look as if the UK might have done very well indeed!

## Thursday 25th July

There is commotion at the adjacent (Netherlands I think) table at breakfast when a large iguana steals a piece of bread then climbs onto a low-hanging branch to gloat over the spoils and relieve itself into their ceviche. Geoff and I also have some difficult encounters with the locals ahead today, as it is the first day of co-ordination.

This is the process by which the exam papers are marked. Geoff and I have looked at the UK students' scripts, as have a team of local markers, called co-ordinators, who are split between the six questions. In an ideal world, all parties agree on the appropriate mark, so we can sign and head to the beach. In practice, however, the co-ordinators have very little reading time per solution, and are also responsible for ensuring the mark schemes are consistently applied.

Geoff has the 9am slot for Q4. Despite having prepared meticulous analysis of each UK student's treatment of degenerate cases, we sign for 42/42 in a matter of seconds. Not such a baptism of fire after all. I am dealing with Q5 after lunch. They feel that Sahl has not finished the problem. I explain his argument in a slightly less minimalist fashion and they agree, getting the 41/42 we were looking for. We finish the day with Q1, which proves as straightforward as Q4.

Everyone is pleased with progress so far, but also aware that tomorrow will be the tricky day, with the three hardest questions, including two which feature long combinatorial essays rather heavily. Geoff and I retire early to immerse ourselves in mathematics.

In the end I do spend a token amount of time asleep. Q6 is the main cause of my insomnia. Andrew has written a long argument that, astonishingly, combines both official solutions. Unfortunately he claims some results as trivial which the model answer devotes up to a page to proving, so we fear 6 is the best we can hope for, though explaining what is going on may take some time. Meanwhile Matei has come up with a very satisfying original argument, but has run out of time to finish it. In order to convince the co-ordinators that this will work, I cobble together the final steps and practice my speed-L<sup>A</sup>T<sub>E</sub>X while the sun rises.

## Friday 26th July

First thing in the morning, and Geoff is trying to snare some partial marks on the hard geometry Q3. We feel Andrew deserves a point for some non-trivial progress in his rough work. The co-ordinators disagree and despite his entreaties we are forced to sign for a total of zero. The double combinatorics slog begins after lunch with Q2. We are able to get an extra mark for Gabriel bringing him to a total of 25 which will now surely be enough for a silver.

We are scheduled to be last to co-ordinate Q6, at 5.30pm. Aware that our arguments might take a while, and reluctant to hold up the machinations of the entire competition, we loiter and hope for an earlier slot. We end up with the problem captain for Q6 and the chief co-ordinator for all problems, so there would be no higher authority to resolve any disputes apart from an unprecedented (for the UK) appeal to the jury.

Daniel's work turns out to be the main problem. He has not had much time, so has done the calculations for the increments of the inductive construction, and merely described how the induction itself works. The mark scheme looks very rigid, but appears to offer 4 marks for this, so I ask for that, and predictably the co-ordinators look surprised. We wrangle for a very long time indeed, but in the end I'm unable to convince them that despite the lack of proofs of the more technical part of the solution it is still worth at least 3. This



extra mark would have earned Daniel a gold medal, so it is a shame, but he can perhaps draw some consolation from the fact that the regime was undoubtedly applied very fairly.

Matei and Andrew's arguments also require lots of attention and I am glad I prepared thoroughly, but in the end we get the 5 and 6 respectively that we wanted. They are now ensured strong gold medals. Geoff and I retire to the bar to toast what has been a record-breaking performance by the team, coming 9th overall, and top of the EU by some margin.

There follows the final jury meeting, where speeches are made by various team leaders, before the decision on the medal boundaries. There are no real controversies, and we end in good time to celebrate with our success and friends' successes (not least a 15th place for Australia and top-ten individual score for AUS2 Alex Gunning) late into the night. I fear the supplies of Cachaça have been hit rather hard.

## **Saturday 27th July**

The optional morning excursion to the nearby town of El Rodadero is generally spurned in favour of a lie-in and a final chance to enjoy the beach and the pool on the roof of my hotel. The now-familiar convoy of buses gathers at dusk to transport the IMO to the nearby Quinta de San Pedro Alejandrino, site of Simón Bolívar's impressive tomb, and location for the Closing Ceremony. First there are several speeches and performances from traditional singers and dancers. The mixing desk suffers some unfortunate problems, so the sound engineering for the ridiculously skilful young accordion player consists of a technician walking a single microphone from one side of the instrument to the other as the register changes.

The main event is the presentation of the medals. The UK students all do a good job of getting their Union Jacks in front of the competing flags from adjacent competitors. The space in front of the stage turns into a bit of a scrum of photographers. I turn out to be substantially bigger than the average South-East Asian mathematician, and so get some unobstructed shots of our gold medallists.

During a further long sequence of dancing, everyone starts to drift away back towards the closing dinner at our Irotama hotel. It turns out that the British Maths Olympiad booklets have finally arrived at this late hour. Gabriel and his new friend from the Irish delegation do an excellent job of speedily distributing them amongst all the teams. After a slow start, the dance floor gradually fills while a table of deputy leaders watches on with a mixture of enthusiasm, concern and indifference. Some final goodbyes are said; others plan to chat the whole night away. This year's IMO draws to a close.

## Sunday 28th / Monday 29th July

We leave for picturesque Santa Marta airport after breakfast. It appears that some of the team have spent a non-zero time asleep. The short hop to Bogotá is almost entirely made up of mathematicians, and there are plenty of paper pads and Rubik's cubes out in the departure lounge (remembering of course that compasses can't be taken in hand luggage).

A short change in Bogotá is enlivened when the ever-suspect Andrew Carlotti is summoned by the police. It turns out to be merely a random inspection. Geoff and I muse over plans for next year, and I learn that *The Glass Bead Game* is a very useful tool for getting to sleep when you thought you weren't tired.

After a layover and much-needed triple espresso in Madrid, and an initial aborted landing at windy Heathrow, everyone is united with adoring parents and other fans. Despite Geoff's best efforts, his dream of a flash-heavy welcome by the national press fails to come to fruition. We live in hope for next year.