Report

on the

33rd International Physics Olympiad

July 21 - 30, 2002

Bali, Indonesia

Prepared

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for the

Foundation for Education Science and Technology

August 2002

1 Introduction

This report is a result of an invitation sent to me (1) by Dr Triyanta, Physics Department, Bandung Institute of Technology, Indonesia, who is the Chairman of the Organizing Committee of the 33rd International Physics Olympiad, IPhO, held in Bali. Funding for me to attend as an Observer was granted by the Foundation for Education, Science and Technology, FEST.

The main objectives of my attendance were to:

- better understand what the IPhO is about,
- judge the standards of the IPhO,
- see whether or not South Africa is able to compete in the IPhO,
- see what alternatives to the IPhO exist with a view to looking into the possibility of forming a Pan African Physics Olympiad, PAPhO,
- attend the First Congress of the World Federation of Physics Competitions, WFPhC, which immediately follows the 33rd IPhO.

This report is intended to enable FEST to make objective decisions on:

- whether South Africa can, and if so, should compete in the IPhO,
- whether PAPhO can be formed, and if so, should it be,
- the future role of the South African Youth Science Olympiad.

2 Background

In 1996 I accompanied the South African National Youth Science Olympiad finalists to the London International Youth Science Fortnight during which I met Prof. Rod Jory of the Australian National University, ANU, who got Australia into the IPhO. We struck up a good rapport and I learnt a great deal about the IPhO.

I had been aware of the IPhO for some time but knew little about it, other than that it struck me as odd that there had been no southern hemisphere or African countries participating: last year Kenya was the first African country to compete, but are not competing this year, see below.

Australia was the first southern hemisphere country to compete (recently joined by Brazil) and for this (and other reasons) I maintained contact with Prof Jory for some years, during which time I formulated a strategy that might enable South Africa to compete in the IPhO. However it was not possible to compile a proper proposal without getting some first hand information about the IPhO. To do that an invitation was required to attend as an Observer. Most countries sent an Observer first and then entered a team one or two years later (2).

On the advice of Prof Jory I contacted Dr Waldemar Gorzkowski, President of the IPhO some years ago and asked him for advice and how best to proceed. He confirmed my discussions with Prof Jory: attend the IPhO as an Observer. Invitations to attend are not extended to all nations every year: normally these are decided on at the previous IPhO. An invitation to attend the 33rd IPhO was the first opportunity for South Africa to send an observer after initial contact was made.

3 The International Physics Olympiad

3.1 **History** - The full history of the IPhO is available on the homepage, but briefly the IPhO is an international physics competition for secondary or high school students hosted by a different country each year. The first such competition was held in 1967 and organized by Prof. Czeslaw Scislowski in Warsaw, Poland. Since then there has been an IPhO, with few exceptions, each year (3). Originally held only in Eastern Europe, it rapidly expanded in the middle 1970's to include European

countries and eventually overseas countries such as the USA, Middle East and the Far East beginning to compete in the 1980's. Australia started competing in the early 1990's and South American countries in the late 1990's.

As more and more countries started competing so the statutes were changed as was the language policy, with English now the sole language of the Olympiad.

The aim is to promote physics and physics education at school level and to improve contacts amongst both students and teachers of physics across national boundaries. It should be noted that it is a competition between individuals and not countries: countries acts as facilitators.

3.2 **Statutes** - The IPhO is guided and run according to a set of Statutes (4). These statutes are strictly adhered to. In addition there are regulations, these are statements that are of a lower standing than the statutes and can be thought of as 'amendments' or 'support' statements to the statutes.

Members of the LOC, the IPhO president and secretary, Team Leaders and Observers make up the International Board. This board meets regularly during the IPhO, to discuss various issues such as the Olympiad questions and solutions, procedures, syllabus etc. With the exception of Observers, everyone has the right to vote, most matters that go to the vote need only a simple majority for the issue to be carried. Only changes to the Statutes need a 2/3 majority.

The language of the Olympiad is English: all communications, exams, etc are in English. This has been laid down in the Statutes.

3.3 **Syllabus** - Since different countries have different syllabi and curricula, the IPhO has laid down a syllabus and this gets discussed each Olympiad when the syllabus for the next Olympiad is determined. Usually there is no change, but as is to be expected that in the normal course of events, changes will be needed. (5)

3.4 **Participants** - Each country can send:

- a team consisting of two Team Leaders a maximum of five students,
- Visitors, these are often partners of the Team Leaders or support staff, and
- Observers, to either help the team or, as in my case, to represent a country with the aim of learning more about the IPhO with a view to future participation

The difference between Visitors and Observers is that Visitors cannot participate in the International Board meetings and thus cannot contribute or participate in the academic aspects of the competition.

3.5 **Exams** - There are two exams, each lasting five hours. There is a theoretical exam that contains three questions worth 10 marks each and a practical exam with two questions for 10 marks each. The maximum score is therefore 50 marks. The questions are set by the host country and discussed by the international board prior to them being finalized and written by the students. These are then translated into whatever language each country is most comfortable with, see also further remarks on this in #7 below.

3.6 **Prizes** - four categories of prizes are awarded so that:

- the top 60% get an Honourable Mention,
- the top 36% will get a bronze, silver or gold medal,
- the top 18% will get a silver or gold medal, and
- the top 6% will get a gold medal.

In addition special prizes can be awarded. For example at the 32nd IPhO there were prizes for the:

- absolute winner,
- best experimental score,
- best theoretical score,
- best participant from the host country, and
- best participant from countries that participated for the first time.

It should be noted that there are no prizes for countries

4 Organization of the 33rd IPhO

4.1 **Logo** - As with all these conferences and competitions each have their own logo and 'catch phrase'. The IPhO 33 logo is well illustrated in the appendices and its triangular shape has great significance for the Balinese people, (6). The 'catch phrase' "Be one of the Proud Few" I first thought to be a little elitist but as the Olympiad progressed and I got to know the others I got used to it and the reasons for it: similar to the accommodation, see 4.4 below.

4.2 **Travel arrangements -** all participants make their own arrangements for getting to the Olympiad. The host country is then responsible for all other travel requirements for the duration of the Olympiad, this included transfers from and to the airport. This was most efficient and the Local Organising Committee had made special customs and immigration arrangements to facilitate a smooth arrival procedure. Bali airport was particularly busy and from other guests on the island I gather that what took us a few minutes took them nearly an hour!

4.3 **Opening Ceremony** - this was a most impressive occasion. All participants had been asked to dress formally or in national dress. Whilst everyone waited for Mrs Megawati Sukarnoputri, the President of the Republic of Indonesia to arrive, Balinese music was played.

On her arrival, the choir of the University of Udayana sang the national anthem. This was followed by several speeches after which the Indonesian President officially opened the Olympiad and signed a First Day Cover. This was followed by further choral and other music and some traditional Balinese dancing, (7).

The significance of the President of a nation attending and opening such a competition cannot be overemphasized. See also #9 below. To further enhance this, the ambassadors of several countries also attended, including the South African ambassador, Mr Norman Mashabane to whom I managed to speak after the opening.

4.4 **Accommodation** - Team Leaders, Observers and Visitors were accommodated in the Sheraton Nusa Indah, a luxurious 5-star hotel on Nusa Dua, about 20 minutes by bus south of Denpasar, the capital of Bali. The students were accommodated in the Grand Bali Beach hotel, similar to the Sheraton but located on the east side of the island about 45 minutes away by bus.

Both these hotels had excellent facilities for running such a huge competition. The Sheraton has attached to it the Bali International Conference Centre: the only venue that could host the 600+ participants, leaders and support staff, whilst the Grand Bali Beach hotel had a large enough facility for the students to write their exams in. Even so, the practical exam was run in two 5 hour sessions.

This standard of accommodation at first appeared a little excessive to me, but on further reflection, and as the Olympiad progressed, I began to realize that this had been done deliberately to show the students, leaders and other support staff that physics was special and important and that these are the rewards for the time and commitment that they have put into getting here. National sports teams also stay in similar venues when they are on a tour, and intellectual pursuits should not be seen as second class activities. Of course the word of mouth feedback, and the media coverage that these teams get also helps to promote, not only physics, but science in general.

4.5 **Guides** - All student teams had a local student allocated to them. The aim here was not to just act as a chaperone, but also to help the students with local customs, language and generally to be on hand to help out when and wherever they can: many of these students had never been away from home, let alone travelled to a foreign country. These guides are an important aspect of the IPhO as leaders and students are separated for 'security' reasons, see # 10.1. Generally students go on tours as a group and then the 'guides' act as guides. If individual teams go out, then they go as a group with their guide - never singly.

Of course another very good and practical reasons for separating the teams from the leaders: there are very few places that can accommodate this large number of people and supply nearby venues exams and practicals as well as offices, breakaway venues etc.

4.6 **Venue -** The Bali International Convention Centre at the Nusa Indah Sheraton was used for the Opening and closing Ceremonies . In the centre there were also several smaller venues for lunches, dinners, meeting room, office space and breakaways. As was mentioned earlier the students wrote their exams in the Grand Bali Beach Hotel.

4.7 **Programme** - There were two parallel programmes (8): one for the leaders and one for the students. The reason for this is that whilst the papers are being prepared the students have nothing to do, this enables them to get used to their environment, adjust to jet-lag (see #6.3 below) and generally get their minds set for the task ahead. Once students start writing their exams, leaders and observers can attend to other matters such as board meetings, marking, moderating and the occasional outing/tour. On the whole it was felt that this years programme was good in that there was ample time to do the required tasks well without rushing.

4.8 **Facilities** - All facilities needed to run such a competition were excellent. Each country had access to a computer. These were networked to the LOC computer. This allowed the rapid dissemination of information about papers, solutions, translations etc. Photocopying facilities were also on hand, although every effort was made to do as much digitally as possible.

The LOC had organized a good commercial Internet link, about R6 per 15 minutes, as well as banking, postal, insurance and shopping facilities.

The LOC also produced a daily Newsletter (9) in full colour, this was informative and served as an excellent unifying link. It contained some news, puzzles, quiz questions, highlights of the next days programme and some images of the previous days activities. I submitted a little problem which was accepted and I gather generally appreciated. Nice way of telling everyone that South Africa was there!

4.9 **Distribution of Information** - There were several simple ways in which this was done, the most common one was the strategic placement of notice boards telling delegates where meals were, where buses were leaving from and at what time. The newsletter was another efficient way of letting delegates know of events and happenings. In addition to these there were the board meetings.

4.10 **Proceedings** - Proceedings of the 33rd Olympiad will be produced and will presumably be similar to those produced for the 32nd Olympiad in Turkey, 2001, copy available.

4.11 **Prize Giving** - As with the opening ceremony, this was a dignified and colourful affair run in an extremely efficient way. The programme (10) started with some music after which the Minister of Education and various ambassadors and other dignitaries arrived. The was followed by a series of short address after which the presentations were made. These were interspersed with some music and dancing culminating in the award of the overall winner, (11). Notable was the fact that Iran gained 5 gold medals - the maximum possible, and several other of the poorer/less developed countries did extremely well.

4.12 **Board Meetings** - There were several of these to discuss the exams, solutions and moderation. There were also two other meetings to discuss business issues: the three important ones being the question

of Olympiad fees or contributions, cheating and a letter from the IOC.

Fees - at present countries contribute a voluntary participation fee of US$3 500 per team, which includes full accommodation, meals, tours and transport. This is a voluntary fee and those countries who cannot afford it but are capable of participating can attend without paying - although this seldom happens, see #5.1 below. A proposal was submitted and discussed. The board voted against this for a variety of reasons and opted to retain the present structure since it works very well.

There was a proposal by the British delegation that countries found to be cheating should have their team disqualified for three years and their leaders involved permanently banned from future IPhO's. There was a substantial discussion on this point and the proposal was eventually rejected and will be replaced with a more moderate proposal. The reason being that most delegates felt it was unfair to punish potentially good students for a crime they hadn't committed or been involved with in any way.

The IOC (International Olympic Committee) submitted a letter to the IPhO, and other Olympiads, complaining about the fact that these competitions were called "Olympiads". The IOC felt that they had ownership of the words *Olympic* and/or *Olympiad*. The board thought that they had the right to the Olympic Games logo of the 5 interlocking rings but not the words. The president then presented his response which was unanimously approved. It appeared that several countries received similar letters as did the IMO secretary Prof. John Webb of South Africa, who was sent a copy of the IPhO reply.

4.13 **Related Events** - With one exception, these had no bearing on the IPhO 33, but it was interesting to note that such a major event was used to promote/raise awareness of several other physics related meetings:

- The First Congress of the World Federation of Physics Competitions, see separate report,
- Congress of the Physics Teachers of Indonesia, this will be opened by the Minister of National Education and attended by over 600 physics teachers,
- Physics Education Exhibition which will show students work related with physics,
- The XIX National Physics Symposium of the Indonesian Physical Society which is similar to our own SAIP conference.

In addition to the above, Indonesia produced a new set of stamps to commemorate the occasion and it was the first day cover of this set of stamps that the President of Indonesia signed at the official opening.

4.14 **Media Coverage** - There was frequent and extensive media coverage of the IPhO 33, both electronic and the printed press, especially at the opening, prize giving and closing ceremonies. I did see the occasional piece on local TV, but of course couldn't understand!

I have no idea how far this went beyond the borders of Indonesia, but I do know that the Australian team got an official welcoming home reception from their Minister of Education accompanied by various other dignitaries at the Sydney Powerhouse Museum, the local Science Centre. In his address to the successful Olympiad teams he stated on national television that the medals these teams had won were at least as significant as the Olympic medals!

5 Attendance at the 33rd IPhO

5.1 **Countries Represented** - This year saw the largest number of countries taking part: 72 in all, including observers. The IPhO is a totally non-political organization and no country is barred from entering for political reasons. However due to prevailing political situations in some countries they did not attend, notable amongst these were Israel and the USA. For example it was pleasing to see the Indian and Pakistani teams sing togther at the closing ceremony: this emphasized the fact that this was about physics and people getting to know each other: political differences were buried in the true tradition of the Olympic ideal.

I was hoping to meet with the Nigerian Observer and the Kenyan team, but unfortunately the Nigerian representative had apparently had an accident and was unable to attend and the Kenyan team withdrew due to a lack of funds. This was a pity and left me as the sole African representative.

There is a list (12) of all those who attended. This also gives a good indication of the make up of teams. For example the Chinese Taipei team was large, two Team Leaders and eight Observers. Japan, Kuwait and South Africa sent Observers.

5.2 **Types of Representation** - As has been mentioned above, countries take part as competitors with teams consisting a two Team Leaders and a team of at most five students. Countries can also send Visitors and Observers.

6 Teams and the Selection Process

6.1 **Team Structure** - There are two team Leaders, typically one physicist and one pedagogue, usually a physics teacher: these are usually designated Team Leader 1 and Team Leader 2. Some countries send additional members as Observers/Visitors to assist the team leaders with their duties. Students must be less than 20 years of age by June 1st of the year of the competition. They must also be full time students at a recognized school: **not** a tertiary college or university. The Team Leader 1 is responsible the entire team and he/she has the final say in any decision relating to the team. Different countries adopt very different approaches to team management. Some teams have two experienced physicists from tertiary institutions, whilst others send two good physics teachers, but generally speaking there is usually one physicist and one experienced physics teacher.

Australia, Canada, UK, USA and some others are moving towards a combination of experience and youth. These countries have successfully implemented the system whereby the Team Leader 1, a physicist, is accompanied by a recent successful student as Team Leader 2. This student would be well on his/her way at university, but young enough to still have an excellent rapport with the students in the team. This system also maintains a continuity of expertise that would otherwise be difficult to achieve.

6.2 **Selection Process** - All countries, without exception, had some sort of national selection process. I felt that the South African Science Olympiad was as good as any and better than most in its ability to select students for a team. It would probably need some fine tuning and development, but we are better off than many other countries.

Pakistan for example use the results of their 2nd last year school exam (Gr11 SA equivalent). and invite the top 10% to write a physics exam, from which they select about 50 for further training by means of correspondence questions. From there the top 20 attend a three week training camp after which the IPhO team is selected.

India has a three stage system, (13).

Stage 1. Students are invited to write Olympiad papers in Biology, Chemistry and Physics at a large number of centres around the country. The physics exam consists part A, two types of multiple choice, MC, questions and part B, some short answer questions. The MC are marked and the top 10% have their part B assessed, the combined score of parts A and B being used to select candidates for stage2.
Stage 2. The top 200 -250 students from Stage 1 are selected to write the National Olympiad which consists of a 4-hour theory exam and a 4-hour practical.
Stage 3. The top 30 or so are invited to attend a three week training camp after which the IPhO team is selected.

The above two examples are fairly typical: the basic format is a two or three stage selection process followed by a training camp after which the IPhO team is selected. Some countries select students at a much earlier stage and train them at science and technology schools over a period of years. It is

important to note that **all** countries write **separate** physics, chemistry and biology exams, no matter what their selection process was.

6.3 **Training** - This varies a great deal. Many countries train their potential team members by correspondence for about a year, often with the support of a local school, training college or university. This would frequently be interspersed with short camps during school holidays. In some cases this also serves as a further selection process as some students will fall way during this time. The final training camp is often for about 20 - 30 students.

A short time before the Olympiad takes place, all countries train their potential team members for about three weeks at the final camp held at a central venue, usually a university or training college. At the end of which the IPhO team of five is selected. This training is very rigorous and participants are given lectures on physics, problem solving and practical work by specialists and previous IPhO team members. They write exams under similar conditions to the actual IPhO and also do many practicals - often using previous IPhO questions.

The Olympiad is highly competitive and some countries go to great lengths to settle and acclimatize their teams. The Australians for example this year took their team to Perth for their training camp since it was in the same time zone as Bali and only 3½ hours away by plane. In previous years they have gone to the town where the Olympiad is held a week before hand for the same reason!

7 The Olympiad Exams

7.1 **The Papers** - the host country sets the questions and typically these are of a high standard: at a level about 18 month post matric, (14). There are two 5 hour papers, a theoretical paper of three questions and a practical paper of two questions. In each case a reserve question is set, but these are held back and not made public, unless required, see #7.2 below.

General opinion was that there were some interesting and good questions. In particular the 2nd practical question about the “optical black box” was very highly regarded.

7.2 **Discussion of Questions** - the questions are distributed during an International Board meeting, with the question setter present, and discussed. After which the solutions are distributed and also discussed, and changes, where necessary, are recommended and discussed until the Board accepts the question and the solution. It is possible that the question is deemed to be unsuitable and withdrawn and the ‘reserve’ question is then discussed, on the understanding that the discarded question cannot be recalled if there is dissatisfaction with the reserve question. There is thus an understandable reluctance to throw a question out!

This process applies to both the theoretical and practical questions. With the practical questions, the apparatus is also presented and anticipated problems discussed, again, until the majority of the Board is satisfied.

There was some discussion on the exam setting process, some saying that the process is flawed in that there was too little time to really get to grips with the problems. It was suggested that the questions should be set earlier and distributed so that whatever queries arose could be properly discussed. There was dissent on this on the grounds that this could lead to cheating.

But on the whole I, and most others, think that the questions were good and varied. There was a feeling that the 3rd question of the theoretical paper was to long and fiddly: but then in real life this is sometimes the case - the question was accepted!

7.3 **Translation** - The questions are then corrected and the final English versions made available on the internal computer network after which they are translated into whatever language the team leader decides is best for his/her students. This is a long and complex process and a fair amount of latitude is allowed.

Even the English speaking countries 'translate' the papers since quite often different countries speaking the same language still express things differently. It should also be remembered that the host country seldom has English as its first language, often resulting in some strange, but understandable, form of English. However the **intent** of the question is clear, and that where the emphasis is placed. All countries take this opportunity to present the questions in such a way that their students have a good understanding the questions to give them a fair chance of answering them. See also #10.1 below.

7.4 **Marking and Grading** - All exams are photocopied. Each team leader gets a copy of their team's exams and marks them. The IPhO marking team of 36 also marks the papers, this process takes about two days after which the IPhO releases marks to individual teams: they are not made public. The following morning the International Board meets and the breakdown or "cut-off" points for the medals and Honourable Mentions are discussed and voted on.

7.5 **Moderation** - The team leaders then have the opportunity to discuss discrepancies with the markers. The leaders try to justify their marks as opposed to the IPhO's marks should there be a difference. This is hard bargaining, because a few marks can make the difference between one medal or another etc. Each team gets 25 minutes per question to discuss disputes. If there is a real difference of opinion and the leaders and markers cannot reach a consensus, an arbitrator is called in. If the problem can still not be resolved, then there is a full International Board Meeting and the dispute is discussed and voted on. There is no court of appeal.

Each team is allotted a time slot and place. A bell is rung, moderations start and have to cease when the next bell is rung, 25 minutes later. If there is still a dispute it is arbitrated later. If a team does not arrive on time it is deemed that they have accepted the IPhO mark.

Once agreement has been reached the question is signed off by both markers and Team Leaders and these are the marks that will then go forward for awards, if any.

8 Funding

I spoke to many team leaders and with the exception of Australia, all the teams were funded by their national Education Departments or other government agencies. The Australians receive substantial support from the Rio Tinto Mining group. This funding includes the selection process, training camps, pre-Olympiad transport, accommodation, payment for support staff and of course support for getting to the IPhO.

For the 33rd IPhO the Indonesian government funded the bulk* of the entire Olympiad and the 1st Congress of the World Federation of Physics Competitions, WFPhC, I do not know the exact cost, but I estimate something in excess of US$1Million. The Asian Physics Olympiad, APhO, see below, held earlier this year cost the Singapore government US$400 000.

* Most countries paid the voluntary fee of US$3 500 per team (US$1 200 per observer), but this represents only about 20% of the total costs of the IPhO.

9 Other Olympiads

9.1 **Physics** - The IPhO is the major international competition, but as with sport, there are several more localized competitions to suit local language groups or regions. For example there is the Asian Physics Olympiad, APhO and the Ibero-American Physics Olympiad, IAPhO.

APhO caters for the countries on the Asian continent and include membership extending from Korea and China in the east to Turkey in the west. Through some tactical negotiations, Australia also takes part in APhO! As is the case with the IPhO, the language used here is English: it is therefore a regional Olympiad, as opposed to a linguistic or cultural association.

IAPhO is a linguistic and cultural association in that it basically caters for the 'Latin American' countries, using the experience of Spain to assist with the setting up and running of this Olympiad.

In addition, **all** other countries competing in the IPhO have their own Physics Olympiad which is used as a recruiting, selecting and training process for the IPhO.

9.2 **Others** - The International Mathematics Olympiad, IMO, is now very well established and is one in which South Africa competes successfully. There is also the recently formed Pan-African Mathematics Olympiad, PAMO, in which South Africa also competes successfully.

In addition there are international Olympiads for Chemistry, Biology and Informatics, all of which are supported by national governments. Some countries are also beginning to compete in an Astronomy Olympiad: Australia is hoping to start that next year as well. Some of the olympiads are also becoming 'regionalized': an indication that these are considered in a serious light as productive competitions.

10 General

10.1 **Trust** - Team being separated from the leaders - (cf # 4.4 - Guides) - I can see this being necessary in the past, but with modern technology this becomes an impossible task: cellphones, mobile scanners, digital cameras and computers make it easy for competitors to cheat if they want. In my discussions on this issue, it appears that there has to be a certain amount of trust as there is no other way if you want to discuss the questions before the students write. General feeling is that if you cheat and win, then that is something you have to live with - eventually it will come out.

The same applies to the translating: in many cases there is only one country with a particular language. This leaves the way open for leaders to insert hints and/or comments to help the students. Again this will eventually come to light as all translated papers are kept for record purposes, and the translators know this.

The British Team wanted to add a regulation to the Statutes stating that if a team was found to be cheating then that country would be banned from attending for three years, and the leaders permanently banned from the IPhO. General consensus was that this would only punish the innocent. This was therefore rejected and a modified version will be added to the regulations later.

10.2 **Towards PAPhO** - Dr Juan Leon, Team Leader from Spain, mentioned to me that he had been approached by Angola to ask if they could join in with the Ibero-American Olympiad. He had as yet not yet responded to this request, and that it would be raised at their next meeting. However he did suggest that it would in fact be better if they could join a Pan-African Physics Olympiad, should such an olympiad be created. There is a great deal of support for the formation of PAPhO and the IPhO is more than willing to assist in setting up such an organization: the statutes as drawn up by APhO could well be used in setting up PAPhO.

10.3 **Interactions** - During the Olympiad I made a point of speaking to as many representatives from countries with similar multi-cultural and social situations as South Africa as well as countries who had recently started competing in the IPhO, so as to best learn from their experiences.

To this end I spoke at length with the representatives from Brazil, India, Pakistan, Mexico, Indonesia, Surinam and Turkey. Whilst it is difficult to remember and document details, several important similarities emerged from these discussions, all had:

- substantial support from their governments: financial, material and moral,
- sent observers first, developed a strategy and then entered the IPhO,
- seen this as a way to stimulate their flagging enrollments in the sciences, particularly physics,
- similar selection processes via a national physics olympiad leading to a training camp and eventual

team selection.

Because of my previous relationship with Prof. Rod Jory from Australia I developed extremely good relations with the Australian Team Leaders, Colin Taylor and Grant Schuster, and admired their single-minded and focussed approach to IPhO participation. As with many Australian activities (including sport) their approach is simply this:

- is this worth taking part in?
- if yes, do the research,
- put up the money,
- set up the infra-structure,
- recruit staff and select students, and
- in five years time account for yourselves!

They have an organization solely set-up to run the Science Olympiads: physics, chemistry, biology, mathematics and informatics, with astronomy to be added. This, as mentioned earlier, is partially sponsored by Rio Tinto, but strongly supported by government, and has a very sound infra-structure that could well serve as a model for South Africa.

In addition, for linguistic (Dutch/English) and cultural (new world) reasons, I developed extremely good rapport with the teams from Ireland, UK, Australia, Canada, Surinam, Belgium and the Netherlands. They were all extremely supportive and genuinely look forward to South African participation in the future. It turns out that Hans Jordens (Netherlands) and Andrzej Kotlicki (Canada) are both very senior members within the IPhO and I spent a considerable amount of time with them, professionally (helping with translation and exam in-put), and socially and I learnt a great deal from them. I was accepted as an 'extra' member of the Dutch leadership team and this gave me an enormous insight and sound understanding of the workings of the IPhO.

I also had extensive discussions with Prof. Waldemar Gorzkowski, President of the IPhO. He is extremely supportive (he made a point of looking me up at the start of IPhO 33) and helpful, gave me valuable input into how to set about becoming a competitive participant in the IPhO, and offered to help wherever he can: he set up meetings for me with Prof Ming-Juey Lin, Chinese Taipei (Taiwan) and Prof. Suwan Kusamran, Thailand. Both of which were productive: Prof Lin verbally invited South Africa to attend the 2003 Olympiad in Taiwan! Prof Gorzkowski has also already helped Johannes Surya (Indonesia) set up the APhO and Juan Leon (Spain) with the IAPhO.

10.4 **Social Activity** - There were many times when there was little time for any social activity especially during the exam discussions, translation and moderation when work continued well into the night, 22h00 was not uncommon and some teams didn't get to bed till breakfast time! Having said that there were several times when the LOC had set up tours, dinners and entertainment for delegates and they are to be complimented and thanked for this. These were necessary breaks and we all got to see a good deal of Bali and came to understand a little of its rich and varied culture: the hotel whilst excellent, was often referred to as "Swiss Chocolate"! These were times when one got to know people in a more relaxed atmosphere and got a better insight into their reasons for being there. The programme and Newspapers give details of these outings and tours.

It is worthwhile noting that what is marked as 'free time' in the programme was often extra time to absorb over-runs from other activities, such as marking and preparation for moderation!

11 Strategy

11.1 **Introduction** - As a result of my visit to the 33rd IPhO I now have a thorough understanding of what this competition is about and would like to put forward some points that will help to clarify a strategy that will allow South Africa to compete. Standards are very high and South African students cannot take part in

the foreseeable future unless a specific plan is put into place. There is no doubt that South African students are just as capable (cf IMO winners) and not any different from other students around the world: they need to be prepared for competitions such as these. This is no different from any other aspect of human endeavour that strives for excellence: be it sport or intellectual pursuits, Olympiads, chess etc. But South Africa is handicapped in the following two ways:

- the IPhO is organized according to a northern hemisphere timetable. This means that South African students write six months earlier in their school year than their northern hemisphere counterparts: their year ends in June, ours in December and competitors must be bona fide school students,
- in our curriculum Physical Science is taught: this means that our students are at least one year behind their northern hemisphere counterparts i.t.o physics.

11.2 Selecting students - Our present Olympiad is good in selecting potential students, but in order to identify, and be able to select, good physics students I would suggest a third round in the Olympiad just on Physics for about 50 selected students, not necessarily the top 50. This round would include some proper problems with written solutions and could be done in conjunction with the South African Institute of Physics, SAIP. From these 50, at least 5, ideally between 5 and 10 students (numbers depending on funding) would be selected for the final training phase from which the IPhO team would be selected. At each stage of the selection process cognizance should be taken of the background of the potential team members in an attempt to make the team competitive, but also as representative as possible. The aim should be to eventually get a truly representative team selected on merit only.

11.3 Training students - As mentioned earlier, South African students are about 18 months behind their counterparts in other parts of the world. Bearing in mind that the team members need to be attending a recognized school and that the South African matric is not of sufficient standing to allow our students to compete alternative methods need to be sought.

One short term solution would be to select at least 5 (preferably 7 or 10) students and enrol them in a school that runs a post-matric year and that is located near a university or training college (the former is preferable). For the first 6 months of the year the students would undergo training in theory and practical work that would enable them to become competitive by the time the IPhO takes place. Several such schools have been tentatively approached and are willing/keen to become involved in this process.

There needs to be a belief that this will achieve something for South Africa and would require the full cooperation of the school and the university involved. In addition the team leaders need to be able, enthusiastic and willing to commit themselves to getting South Africa into the IPhO. In this I think that the Australian model would be worth following.

A long term solution would be to have a Junior Science Olympiad, in addition to the existing Olympiad, at an earlier time, say Gr 9, and then select and train students using holiday camps. This would be a project with a 5 year lead in time, but could in the long run work quite well. The mathematicians do something along these lines.

12 Recommendations

There are many benefits and spin-offs if South Africa were to take part in the IPhO, something I strongly recommend, for the following reasons.

12.1 Benefits for individual team members:

- accelerated learning in physics and the mathematical sciences,
- admission to a peer group of high achieving students,
- leverage with university admission and scholarships,
- internationally recognized level of achievement,

- international experience.
-

12.2 Benefits to universities:

- access to highly motivated students,
- ready picked target group for admissions ands scholarships.

12.3 Benefits to the profession:

- it will improve the status of Physics in South Africa,
- the spin offs i.t.o. post-graduate students are huge, potentially 5+ PhD's pa.
- opportunities to engage with potential high achieving future professionals,
- South Africa will be seen to compete globally in physics and the mathematical sciences,

12.4 The formation of PAPhO - The formation of this organization is important as it enables South Africa to maintain a leading role on the African continent i.t.o. S&T, specifically in the SADC region. In the long run, if African nations are unable to raise individual teams then it might be possible to enter a PAPhO team in addition to a South African team in the IPhO.

In order to make it possible for South Africa to take part and compete (there is a difference!) in the IPhO and to set up the PAPhO I suggest a meeting at which the following can be discussed and formalized so that:

- a Science Olympiad body be set up within FEST to coordinate all Science Olympiads: physics, chemistry, biology and in the future astronomy(?). This I envisage to be similar to the Australian "Rio Tinto Science Olympiads" organization which is headed up by Dr Colin Taylor,
- short and long term goals be identified,
- a budget be discussed.

These discussions then be compiled into a formal proposal which can be submitted to the relevant government department, DACST or DoE, or other organization such as (FEST). Before anything can be implemented a decision, at the highest level, needs to be taken as to whether this is something South Africa wants, or needs, to take part in when a formal proposal such as is suggested above will be needed.

13 Acknowledgements

I would like to take thank the following:

- Foundation for Education, Science and Technology, FEST, for funding my trip to Bali in Indonesia to attend the 33rd IPhO and for their continued efforts in running the South African National Youth Science Olympiad,
- the South African Astronomical Observatory for granting me the time to attend the 33rd IPhO,
- the South African Institute of Physics for continued support,
- Dr Hans Jordens and the Dutch team at the 33rd IPhO for all the support and encouragement and inviting me to represent FEST at the First Congress of the WFPhC,
- Dr Colin Taylor and the Australian team, and Prof. Andrzej Kotlicki and the Canadian team, for inviting me to join them on so many occasions and answering so many of my questions,
- Prof. Waldemar Gorzkowski for continued encouragement and facilitating the invitation to attend the 33rd IPhO,
- The 33rd IPhO LOC, in particular Dr Alexander Iskandar, for support, encouragement and making me so very welcome,
- Prof Ming-Juey Lin, Chinese Taipei (Taiwan) for inviting South Africa to attend the 34th IPhO in Taiwan in 2003.

14 Attachments

14.1 Appendices

Note. Many of these were in colour, but where I was unable to get more than 1 copy I have had to make photo-copies: I have retained the originals. Where colour copies were available, they have been included.

1 Copies of invitations.
2 List of participating countries showing observers prior to competing.
3 List of dates of previous Olympiads and their venues.
4 The Statutes of the IPhO
5 The syllabus of the IPhO
6 Explanation of logo.
7 Programme of the Opening Ceremony
8 IPhO 33 Programme for leaders and students.
9 Copies of Newsletters
10 Invitation to the Prize Giving and Closing Ceremony and programme.
11 List of prizewinners.
12 Attendance list
13 Indian Olympiads brochure.
14 Exam papers and solutions of the 33rd IPhO

14.2 References

1 Proceedings of the 32nd International Physics Olympiad, Antalya, Turkey. June 28 - July 2001.
2 IPhO homepage: www.jyu.fi/ipho
3 IPhO33 homepage: www.fi.itb.ac.id/ipho33