

The International Symposium on Ballistics

The silver jubilee of the International Symposium on Ballistics marks three important events: the selection of Beijing as the symposium venue, the founding of the new International Ballistics Society, and the appearance of this issue of the Journal of Applied Mechanics, containing peer reviewed ballistic papers. This paper presents a brief history that describes some of the origins of international cooperation in the science of ballistics and the creation of the International Symposium on Ballistics.

1 Introduction

The 25th International Symposium on Ballistics (ISB), its silver jubilee, marks two significant points for the study of the science of ballistics at the international level. In the first instance, the holding of the symposium in Beijing, China, represents a significant milestone in terms of expanding the world-wide accessibility of the symposium to ballisticians. In the second instance, the 25th ISB marks the founding of a new international ballistics society with its objective of taking the science of ballistics into the 21st century and allowing for a wider scope of involvement with the running of the society, the development of ballistics science, and the organization of the ISB. It is therefore opportune to set down a brief history of the origins of and drivers for the ISB, some key people behind it, and the evolution of its development and management through the International Ballistics Committee.

2 The International Symposium on Ballistics

The ISB owes its origins to the American Ordnance Association, which in turn evolved via the American Defense Preparedness Association (ADPA) into the National Defense Industrial Association (NDIA). NDIA's Bomb and Warhead Division's long-held and still continuing annual meetings were concerned with ballistics but were classified since they also included program overviews and weapons performance. The U.S. forerunner to the ISB was therefore created to provide an opportunity for U.S. scientists and engineers from universities, industry, and government laboratories to meet together in an open forum to present their current research work, discuss the implications of their work, and identify future lines of research.

The papers and presentations at the ISB meetings were unrefereed and distributed at the meeting to encourage collaborative research and, equally important, encourage new entrants into the field of ballistics. This high level aspiration was later to form a core tenet of the ISB to provide the broadest possible basis for dialog and the presentation of work in progress in an international forum.

Dr. Robert (Bob) Eichelberger, late director of the U.S. Army Ballistics Research Laboratory, and others recognized various NATO country bilateral exchanges at government level and provided an opportunity to establish an unclassified international forum along similar lines to the Bombs and Warheads meetings.

The ISB was therefore founded during the 1970s with the objective of fostering all aspects of the science of ballistics. Its founding fathers was represented by a team of scientific pioneers

in ballistics and were composed of U.S. and European experts. The U.S. side included Dr. Robert Eichelberger, Dr. Louis Zernow, Dr. Pei Chi Chou (Drexel University), Dick Dowd (Martin Marietta Corp.), and Martin Summerfeld (Princeton University). The European side included Dr. Gustav-Adolf Schröder (EMI, Germany), Prof. R.E. Kutterer (ISL Director, France/Germany), Neil Griffiths OBE, (RARDE, UK), Prof. Rudolf Thomanek (MBB, Germany), and Dr. Hans Pasman (TNO, The Netherlands). A primary objective of the symposium was to compare and contrast the state of the art in ballistics in North America and Europe and foster collaboration.

Once again, university and industry attendance at the symposium was highly encouraged so that scientists and engineers in universities and industry might participate in creating, developing, and studying the sciences and technologies that were previously restricted to limited venues of NATO and bilateral exchange agreements. Only NATO member states and other select friendly state attendance was encouraged in light of the "cold war" within which the world was at that time enveloped. This remained the case until 1989.

3 First International Symposium on Ballistics

The first ISB was finally organized in 1974 in Orlando (FL, USA) and was considered a great success with between 100 and 120 attendees. The selection of abstracts was achieved via a series of visits by members of the ADPA ballistics section to the European partner's organizations. This initial ad hoc arrangement has since evolved into the current 2 or 3 days paper selection meeting held 6–9 months before a symposium. The first symposium with its relatively small number of attendees fitted into a small motel conference room. The proceedings were a simply bound set of photocopies of the presented papers.

4 Second and Subsequent Symposia

The second symposium was also organized by ADPA in 1976 at Daytona Beach (FL, USA). The third ISB, held in 1977, was organized by EMI and held in Karlsruhe (Germany). This established the alternation of successive symposia between North America and Europe with a period of about 18 months between symposia. With the end of the cold war and the expansion of participating countries outside of NATO, other countries have requested the opportunity to host and organize a symposium. Of the 24 symposia held to date, USA has hosted 11, Canada with two, Europe with eight (Belgium, France, Germany, Netherlands, Spain, Sweden, Switzerland, and United Kingdom), and Australia, Israel, and South Africa with one each. Very appropriately, China will host the 25th ISB.

The international character of the Symposium, in its broadest sense, rapidly evolved after the end of the cold war and has become one of its defining characteristics. Today, between 300 and 450 ballisticians from 26 countries regularly attend and actively participate in the ISB and in the process help secure its world class reputation. The largest attendance, of over 600, occurred at

the ISB in Stockholm Sweden in 1992, where the meeting was locally hosted by the FOA, the National Defense Research Establishment. In the first symposium in 1974, there were 34 papers, which can be compared with the 280 papers accepted for the symposium in Beijing (2010).

The technical content of the ISB has also evolved and widened to reflect changes in research priorities of national research programs and the interests of the scientific community outside of government research laboratories. It now includes sessions on interior and exterior ballistics, warhead mechanisms, terminal effects, armor and personal protection, and wound ballistics and vulnerability.

Many of the symposia, starting with the third, have witnessed the first presentation in the public domain of papers on themes such as explosively formed projectiles, active and passive armor, and other "sensitive" technologies. The symposia have also reflected the rapid development and application of numerical modeling techniques as well as the ever increasingly sophisticated experimental diagnostic techniques that have followed on the back of the revolution in electronic chip fabrication technology. Their complementary combination has led to an increased understanding of the detailed mechanisms that drive ballistics technologies and the importance of material properties in their realization. The continued evolution of ballistic technologies is clearly reflected in the proceedings of the symposia, which also shows how old technologies have been re-invented and developed for other applications.

The initial ad hoc organization committee, based on two representatives from each representative country, worked well during the period when attendees were restricted to NATO and invited countries. However, with the end of the cold war a new governance model had to be adopted.

5 The International Ballistics Committee

The recognition that a more efficient set of rules to govern the organization of the ISB was required led to the founding of International Ballistics Committee (Fig. 1) (IBC, www.ballistics.org) on Apr. 23, 1993 at a meeting held at the French-German Research Institute—Saint-Louis (ISL) in France. The meeting was chaired by Prof. Eduard Celens (Belgium) and cochaired by Dr.

Gustav-Adolf Schröder (Germany), with Dr. Rob Ijsselstein (The Netherlands) as secretary. Dr. Schröder was elected the first chairman of the IBC.

The IBC is concerned with "promoting the science of ballistics internationally in the broadest sense and has as further objectives: to provide at the highest level a means of interchange and experience in this field by ensuring that at least an ISB takes place approximately every 18 months and that the organization thereof is of a high standard; to organize and conduct additional activities that further the development and advancement of the field of ballistics."

The ISB and their location are now decided by the IBC about 4.5 years in advance of the event to enable adequate planning in order to produce outstanding symposia.

6 Technical Program Development

The IBC has expended considerable effort to improve the scope of the ISB and maximizing the opportunities for those attending a symposium to present their work and network with colleagues. While the oral presentations remain a core element of the ISB, the poster paper sessions now represent the main presentation medium for delegates. The use of the general sessions in the oral presentations have been developed as a vehicle to let delegates gain a fuller understanding of the current research activities in ballistics that may be outside of their immediate area of expertise.

The scope of the ISB has also been widened to include personal protection, which together with vulnerability and wound ballistics are topical areas given current conflicts.

The IBC has continued to encourage high quality papers by supporting prizes and awards. Currently, there are four: the Edith and Louis Zernow award for outstanding advancement in ballistics, the Rosalind and Pei Chi Chou award for young authors, the Neil Griffiths award for outstanding contribution in warheads and shaped charges, and the SABO award for best poster display.

When it comes to the ISB proceedings the IBC has been keen to embrace developments in reproduction technology. As a result the proceedings are now available in a two volume hard back book printed to high quality and an electronic CD. For ISB organized in North America, a copy each of the proceedings is lodged with the Library of Congress to ensure they are always readily accessible to researchers. Beginning at the 13th symposium in Stockholm, all proceedings were also given ISBN numbers, facilitating access. Given the weight and cost of printing these hardback volumes, there is significant pressure to move toward an all electronic version only of the proceedings.

A new experiment initiated by the IBC has been the encouragement of technical workshops and courses to be held on the day before the start of the ISB to enable those new to the study of ballistics to learn from those with a lifetime of experience. The feedback from those who have attended the workshops organized in Tarragona and New Orleans has been very positive.

7 Peer Reviewed Publication and the Journal of Applied Mechanics

As described above, one of the core objectives of the ISB has been to offer a forum for researchers to present their work, including work in progress. Papers were therefore not refereed. For many years, the argument has developed that the IBC should begin to publish some of the more technically mature papers as refereed papers in a suitable journal. A major difficulty in meeting this desire was the lack of a journal that covers all of the topics in the ISB. This, coupled with the cost of setting up and running a new journal, presented two significant obstacles. Nevertheless, the IBC decided to proceed with an experiment starting at the 25th ISB in Beijing, which resulted in a limited number of journal grade papers being refereed and published as this special issue of this journal; a possibility kindly offered by its editor, Prof. Robert M. McMeeking. Professor Bo Janzon, the immediate past IBC chairman, was chosen as the first guest editor.

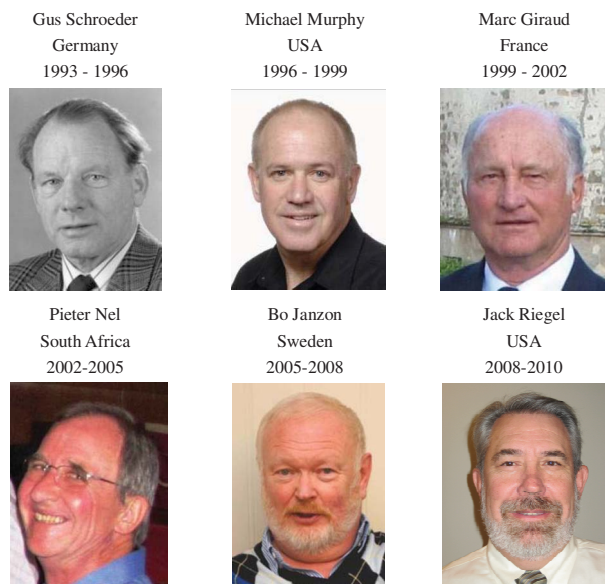


Fig. 1 Chairmen of the International Ballistics Committee 1993–2010

Initially, 56 abstracts were sent in for review. Of those the IBC publications committee advised, about 50% of the authors were to reconsider their aim and submit a shorter paper for the ISB proceedings. Twenty-eight papers were submitted to the Journal of Applied Mechanics (JAM) and after very thorough reviews, 19 of them were finally accepted for publication. This means a total attrition rate of 66%, which is considered quite normal for the JAM.

It became quite evident that many of the authors were not very used to writing papers of a high scientific standard. This has meant that an unusually high load has been placed on the reviewers and the editorial staff. Many of the papers showed considerable initial deficiencies both as concerns scientific strictness and lingual standard. Some manuscripts, that could have been rejected initially but which were judged as scientifically interesting and having good potential, have had to pass through several stages of revisal and rereview, finally succeeding to shape them into good and acceptable papers. It is up to the scientific community to judge if we have succeeded.

This experiment will be continued with a new JAM issue being planned for the ISB 2011, to be organized on Sep. 12–16, 2011 in Miami, FL. For the evaluation of the current issue, the citation rate will be an important variable. However, the ISB will also continue to adhere to its original objective of providing a forum for work in progress.

It is interesting to note that of the four awards distributed at the Symposium two were accorded to papers to be published by the JAM:

The **Chou Award for young authors** to - Chen, X. H. (Susan) and Zhao, R. X.: Rolling Moment Characteristic Analysis of Wrap-Around Fins.

And the **SABO Award for best poster** to - Tao, C. L., Zhang, Y., Li, S. Q. et al.: Mechanism of Interior Ballistic Peak Phenomenon of Guns and its Effects.

Both these were Ph.D. student papers - a very promising sign for the future!

8 Next Steps

After some lengthy discussions within the IBC, the chairman, Dr. Bo Janzon, issued a simple questionnaire to seek the views of the delegates to the 23rd ISB at Tarragona, Spain in 2008. The results showed there was a clear majority interested in the formation of a ballistics society with an elected board of directors. This is very similar to the way in which, for example, the Hypervelocity Impact Society (HVIS) runs its HVIS symposia, where a delegate becomes a member of the society for the period up to the

next symposium. Candidates for the board of directors are nominated from the membership of the Society and all members take part in the elections.

Since the Tarragona ISB (May 2007), Jack Riegel, as IBC chairman, and the executive board have been working out the details of how an international ballistics society could be registered and how it would function. After much hard work, the International Ballistics Society was incorporated and will be fully launched in Beijing, marking a new direction for ballisticians and their science.

Consequently, its organization will necessarily take into account the need for a more streamlined board of directors and a modernized constitution reflecting the new objectives of the Society in order to be more reactive and efficient and so further improve the prestige of the ISB. It will also be an important step toward rejuvenation of the science of ballistics. This represents an exciting future for the ISB and all ballisticians.

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