

# **TC 3 – FROM THE BIRTH TO WORLDWIDE RECOGNITION**

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## **ABSTRACT**

IMEKO TC 3 after 37 years of its founding organises the 19th Conference in Cairo, 2005. The paper gives a survey of the first 16 years, reporting the first 10 Conferences and round table discussions. The most important personalities are mentioned with the development of the field as well. This heroic period was a firm base of the next 20 years and of the future activities.

## **1. THE BIRTH OF IMEKO AND TC 3**

IMEKO TC 3 „Measurement of Force and Mass” is one of the most successful Technical Committees of the International Measurement Confederation. At its 19<sup>th</sup> Conference, after 37 years of its founding it is worth to stop for a moment and look back on the ideas and personalities of origin. It happened in a very early stage of IMEKO itself, therefore it is worth to remember shortly the birth of IMEKO first.

I believe in the fortunate coincidence of a historical necessity and the appearance of an outstanding personality for the realisation of great deeds. That happened in the years 1956-58, when a Hungarian scientist, after his university studies in Austria and 10 years of exile in the US, returned to Hungary and full of energy and enthusiasm established several different institutions, all pointing in the same direction:

- a factory for electronic measuring instruments,
- the Central Measurement Research Laboratory,
- co-founded the Department of Instrumentation at the Budapest Technical University,
- the Scientific Society for Measurement and Automation and
- organised its first Conference on Measurement with international participation in 1958 in Budapest.

This person was Prof. György Striker, later called the Father of IMEKO.

The Conference was followed by a second one in 1961 where an international group of enthusiasts decided to establish the international Measurement Confederation IMEKO with the main task to organise tri-annual Conferences in Eastern and Western countries alternately. This led to the series of World Congresses:

1958 Budapest, 1961 Budapest, 1964 Stockholm, 1967 Warsaw, 1970 Versailles, 1973 Dresden, 1976 London, 1979 Moscow, 1982 Berlin, 1985 Prague, 1988 Houston/Texas, 1991 Beijing, 1994 Torino, 1997 Tampere, 1999 Osaka, 2000 Vienna, 2003 Dubrovnik, 2006 Rio de Janeiro.

I was fortunate to get acquainted with Prof. Striker in 1956 as a starting assistant professor at the same Department. I admired his enthusiasm and internationalism in those years of oppression and when he invited me to his new research institute, I gladly joined him. At the Department my work was to set up a laboratory for electrical measurement of non-electrical quantities. His Institute received a Government project to elaborate electronic weighing

machines in order to quickly fulfil the needs of the fast growing industrial development of the country and the region. The Government officers thought that modern pitless scales can be installed faster and cheaper than traditional weighbridges.

This was a dream in the fifties but at the same time a challenge to me and I undertook to manage the project. This was a decision for all my active life.

I became a close colleague of Prof. Striker and he also asked me to help with his honorary activities in the Society and in IMEKO.

The IMEKO Secretariat was established in Budapest and we went there from the Laboratory 2-3 times a week for continuously growing international activities until late evening.

Karolina Havrilla joined in in 1971 and it was good to see the evolution of IMEKO gaining Member Organisations on the five Continents.

Early at the beginnings the wish emerged to set up Technical Committees where the experts of a narrow field can meet and exchange ideas in more depth. TC1 was established by university professors for education in measurement. One of our colleagues, Dr. Schanda called together TC 2 for Photonic Measurements.

The idea to organise a Conference on Precision Measurements with Strain Gauges for Force and Mass Measurement was formulated by the participants of the Round Table Discussion “Strain Gauge Technology in Industrial Weighing” at the 4<sup>th</sup> IMEKO World Congress in Warsaw, 1967.

## 2. IMEKO TC 3 EVENTS

**The first Conference** was organised in October 1968 in Braunschweig by Dr. K. Hild, with about 150 participants and the historical merit of this event was that it brought together the experts of force measurement with those of mass measurement (weighing) for the first time. The cross-fertilisation of both fields turned out to be so successful that this became the base for the establishment of TC 3 and all its further activities. Outstanding personalities of this Conference were Chr. Rohrbach, K. Horn, H. Wieringa, K. Hottinger and S. Kovacs.

It was proposed at the closing session to continue with the international cooperation of this field in the framework of IMEKO. Thus, IMEKO TC 3 was set up under the Chairmanship of Dr. K. Hild, Scientific Secretary Dr. T. Kemény; with the following tasks:

- to organise symposia on still unpublished results of experiments and practical experience,
- to hold round table discussions on different topics,
- to promote the exchange of experience among IMEKO Member Organisations.

**The second TC 3 Conference** was organised by H. Wieringa in The Hague, 1971 with 22 lectures on the calibration of force measuring devices, force transducer designs, weighing devices, data processing and theoretical considerations. Important new speakers of this Conference were A. Gizmajer, R. C. Debnam, R. F. Jenkins, A. Bray, M. Dubois, M. Kreuzer and P. K. Stein.

**The third IMEKO TC 3 Conference** in Ostrava, 1972 was organised mainly on electronic weighing systems in the process industries, with emphasis on application problems. Some new personalities enriched the meeting, in addition to those mentioned earlier: A. Sawla, W. Weiler, E. Nier, T. Ono, R. Häggström.

An important event of TC 3 was the round table discussion “Force Transfer to Force Measuring Devices” at the 6<sup>th</sup> IMEKO World Congress, 1973, in Dresden. From this time on it became

traditional that TC 3 also participated in the program of IMEKO World Congresses with round tables and scientific sessions as well.

**The fourth TC 3 Conference** was organised by A. Bray in Udine, 1974, mostly on force measurement problems. For the first time there was a report about force measurement in the human body. Some important new speakers: M. Peters, C. Ferrero, M. Murata. Part of the meeting was a round table discussion about problems related to accurate force measuring devices as transfer standards, led by H. Wieringa.

**Table 1**

**History of IMEKO TC3 Conferences**

1. Precision Measurements with Strain Gauges for Force and Mass Measurement, 1968 Braunschweig, Germany. Chairman Dr. Kurt Hild, Founding TC3 Chairman.
  2. The Characteristic Properties of Force Measuring Devices and Electro-Mechanical Weighing Machines, 1971 Den Haag, The Netherlands. Chairman Helmer Wieringa.
  3. The Measurement of Force and Mass in Controlled Systems, 1972 Ostrava, Czechoslovakia. Chairman J. Nutil.
  4. Recent Developments in Force Measuring Devices, 1974 Udine, Italy. Chairman Anthos Bray.
  5. Up-to-Date Verifiable Weighing Machines, 1974 Szeged, Hungary. Chairman Tamás Kemény.
  6. Industrial Weighing, 1977 Odessa, USSR. Chairman V.A. Kovalj.
  7. Measurement of Force and Mass, 1978 Braunschweig, Germany. Chairman Wolfgang Weiler.
  8. Weighing Technology, 1980 Kraków, Poland. Chairman Andrzej Gizmajer.
  9. Weighing and Force Measurement in Trade and Industry, 1983 London, U.K. Chairman R.C. Debnam.
  10. Recent Advances in Weighing Technology and Force Measurement, 1984 Kobe, Japan. Chairman Toshiro Ono.
  11. Mechanical Problems in Measuring Force and Mass, 1986 Amsterdam, The Netherlands. Chairman Helmer Wieringa.
  12. Force Measurement and Weighing in the 90s, 1990 Szeged, Hungary. Chairman Tamás Kemény.
  13. Force and Mass Measurement, 1993 Helsinki, Finland. Chairman Aimo Pusa.
  14. State of the Art in Force and Mass Measurement, 1995 Warsaw, Poland. Chairman Andrzej Gizmajer.
  15. Accuracy, Assurance in Force, Torque and Mass Measurements. Basic Metrology to Industrial Applications, 1996 Madrid, Spain. Chairman José A. Robles Carbonell.
  16. Force, Mass and Torque Measurements in Parallel with Asia-Pacific Symposium on Measurement of Mass and Force. Theory and Practice, 1998 Taejon, Korea. Chairmen Myung Sai Chung and Dae-Im Kang.
  17. Force, Mass and Torque Measurements at Present and in the Future, 2001 Istanbul, Turkey. Chairman Sevda Kacmaz.
  18. International Conference on Force, Mass, Torque, Hardness and Civil Engineering Metrology in the Age of Globalization, 2002 Celle, Germany. Chairman Amritlal Sawla.
- Force, Mass and Torque Theory and Application in Laboratories and Industries, 2005 Cairo, Egypt. Chairman Ahmed A. M. El-Sayed.

**The fifth TC 3 Conference** was organised by myself in Szeged, Hungary in 1974 together with the 4<sup>th</sup> Hungarian Conference on Weighing. The Proceedings contained my rather detailed 14 page analysis of the situation of verifiable electronic weighing systems, starting to gain ground, and the need of international elaboration of approval methods [9]. Terminology problems load cell versus weighing cell (Kraftmessdose-Wägezelle) were also mentioned. Hybrid scales with levers and a single weighing cell appear on the market and solid state data processing systems start replacing the conventional servo-motor potentiometer displays. New personalities joining: M. Plassa, S. Keil, G. Jäger.

The next event of TC 3 was the round table discussion “Measurement of Force and Mass” at the 7<sup>th</sup> IMEKO World Congress in London, 1976.

**The 6<sup>th</sup> TC 3 Conference** was organised in Odessa, Soviet Union in 1977. Some new personalities: K. Bethe, H. Fülles, J. Paetow, F. Sennhenn, K. Kameoka, K. Fristedt.

In 1979 **the 7<sup>th</sup> TC 3 Conference** was held in Braunschweig, organised by W. Weiler. New speakers: Th. Gast, B. Bergquist, B. Meissner, R. Süß, M. Kochsiek. In the same year at the 8<sup>th</sup> IMEKO World Congress, Moscow, the TC 3 round table was organised on “Practical Problems Concerning Force Measuring Devices”.

I am continuing with the analysis of the newest trends in weighing at **the 8<sup>th</sup> TC 3 Conference** in Krakow, 1980. One of the most noticeable changes over the last few years has been the swing from mechanical and electrical devices to those in which electronics have become the major constituent.

The modern load-cell has typically a combined error (which includes nonlinearity, hysteresis, thermal effect and creep) of 0,02 % of span. The appearance of the microprocessor is having a dramatic effect on weighing systems. Some of the basic statements in 1980 were the following:

- Electronic weighing spreads in the whole field, from microbalances to large industrial plants.
- Due to the manifold services of electronic weighing, especially caused by the application of microprocessors, weighing and data-processing, or weighing and process control become integrated in the same electronic unit.
- Almost all electronic weighing systems, except for the micro-balances are based on strain-gauge load-cells.
- In the medium range, hybrid systems offer the best and most economical results.
- At price computing and counting scales weighbridges with only one specially shaped rigid cell, have appeared. In 1979 a new term appeared in the transducer terminology: the “single point” load cell.
- Improvement can be observed concerning verification of electronic weighing systems at different state-authorities.
- Due to transducer design and the development of microelectronics, the intelligence of new systems is improving, and at the same time the price-level is sinking.

The participants of the round table discussion at the Krakow Conference “Load Cells and Force Measuring Devices. Common Characteristics and Differences” found this event so important that it was edited and published in a separate volume by the Istituto di Metrologia “G. Colonnetti”. New speakers: M. Plassa, A. Gosset, C. Volkmann, F. Abdullah and U. Erdem.

At the 9<sup>th</sup> IMEKO World Congress in Berlin, 1982 the theme of the TC 3 round table was “Problems in Respect to the Production and Use of Resistance Strain Gauge Force Transducers

as Transfer Standards". TC 3 created the Working Group "Terminology and Calibration Procedure of Load Cells" led by Prof. A. Bray, in cooperation with OIML.

**The 9<sup>th</sup> TC 3 Conference** was held in London, 1983, organised by R. C. Debnam. Some important new personalities: R. Robinson, J. Mitchell, K. Baethke.

1984 was an important year for TC 3. For the first time the **10<sup>th</sup> Conference** was organised outside Europe, in Kobe, Japan, by T. Ono, with great success. Two round table discussions enriched the program: "The Importance of Scales Industry and the Role of Weighing in the Economy of Developing Countries" and "Parasitic Components of Force Standard Machines". Some new recognised personalities: K. Iizuka, H. Imai, G. Barbato, A. Larsson, R. Schwartz, J. Mast, C. Maeda, R. Jenkins, T. Fukuda.

### **3. SUMMARY OF THE FIRST 16 YEARS**

In its first 16 years IMEKO TC 3 became a real international forum of our field, recognised by the scientists all over the world, by most of the well known production companies and by the leading metrological institutions. The founding Chairman Dr. K. Hild retired and handed over the chairmanship to H. Wieringa, another highly esteemed personality in force measurement. The TC 3 membership grew to include the best experts from 19 countries of 3 continents.

This event was the coronation of the heroic starting period when the officers, event organisers, speakers and participants were breaking through the walls of the cruel bipolar world, helped each other in the most different ways, were happy about the personal career and scientific successes of each other, got acquainted with family members and with the cultures of faraway countries.

I am personally thankful that as Secretary of TC 3 I had the opportunity to meet so many excellent people and to learn from them science, technology and real humanism.

It was good to see how these meetings were growing in audience, in number of countries and in scientific-technological level.

The TC really became a forum where instrument developers, makers, users, metrology scientists and professors met time to time and exchanged views and ideas.

It was good to meet in person famous and recognised personalities of the field. Peter Stein was one of them, whose "Strain Gage Readings" was our basic source of information. Prof. Rohrbach earned international rank by his fundamental work on the stability of strain gauges. The company Hottinger was that time the fastest growing firm, dictating the highest precision. Mr. Kreuzer of HBM enchanted the audience of our Conferences with unbelievable measurement accuracies.

The Dutch dead weight testing machine of Helmer Wieringa and his international intercomparison measurement tours were real milestones. The successor of Dr. Hild, Prof. W. Weiler and his young team, Dr. M. Peters and Dr. A. Sawla developed the PTB Force Laboratory to become world famous. The excellent presentations of K. Horn and R. Häggström on shear force transducers, T. Ono on measurements in weightless conditions, Ch. Maeda on shipboard scales made these early Conferences really enjoyable.

All these established an atmosphere where the participants forced themselves to bring new ideas, new results to the next meeting to each other's great delight. The series of my own presentations reflect the main points of interest of those days [1-9]. More and more young

scientists joined in and this way IMEKO TC3 became the No.1 institution to reflect the world wide situation and development of force, mass and later torque measurement.

The knowledge collected at these events made me publish the first Handbook on Weighing in 1981 which involves in 680 pages of application oriented sections both mechanical and electronic weighing systems [10]. I also got several awards from the Hungarian Patent Office, from the Government and from the Academy of Sciences.

#### **4. CONTINUATION OF ACTIVITIES**

The real international recognition of my work was when upon the proposal of Prof. Gy. Striker the General Council of IMEKO at its 1985 Prague Session elected me Secretary General of the Confederation. I did my best to act in his spirit and was re-elected 6 times, always for the next 3 years period.

TC 3 was fortunate to have after Dr. K. Hild excellent chairmen: H. Wieringa, Dr. A. Sawla and Dr. Dae im Kang and the very industrious and esteemed Scientific Secretary Aimo Pusa.

After the heroic period of the first 16 years the TC 3 Conferences continued in Amsterdam, Szeged, Helsinki, Warsaw, Madrid, Taejon, Istanbul, Celle and now in Cairo. Each of them was a festive event, more familiar to the presently active audience than the history of the first 16 years.

Most of the initiators are retired by now, some are not with us any longer. I don't want to finish this remembrance with sorrowful feelings, therefore I don't mention their names but it should be known that we highly value their activity and their lives are good examples to be followed by the next generations.

The Confederation with its 35 Member Organisations of the 5 Continents got excellent personalities from TC 3 as well: H. Wieringa, A. Bray, T. Ono, A. Pusa, M. Kochsiek, C. Robles as Members of the General Council, Chr. Rohrbach, M. Peters, K. Iizuka as Presidents, Advisory Board and Technical Board Chairmen.

Let me hope that someone else will continue to write the story of the last 20 years of IMEKO TC 3 and the activity will go on with the same success as before. The world became more transparent by the fall of the bipolar system and the Internet is helping us with modern means of communication. Let's make the best use of these favourable circumstances.

#### **5. CONCLUSIONS**

Without being conceited we can rightly state that TC3 activities contributed to the fast development of our field, to reach incredible accuracies, reliability, independence of environmental effects, a great variety of applications and moderate product prices.

The aim of this paper was to remember the early days and to provide a historical retrospection. Keeping the limits of this presentation, I apologise to those not mentioned.

This history may encourage our young participants to follow the tradition: it is interesting, challenging, it helps their personal career and over the paramount aim of technological development it brings lots of cross-border friendships and cultural impacts.

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