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**Report of the ISO International Observer to the 3rd Meeting of the CCAUV,
BIPM, Sèvres, Oct. 2002
(cf. draft agenda of 14/05/02, item 15.2)**

**Recent activities of ISO towards key comparisons and traceability in the field of
vibration and shock acceleration**

1 Introduction

This report updates the information presented to the 2nd meeting of the CCAUV. In Doc. CCAUV-99/12 and Doc. CCAUV-01/05, the International Organization for Standardization outlined the regulations for developing and adopting ISO standards, and presented the standards developed in ISO/TC 108/SC 3 (in Working Group WG 6: *Calibration* in particular). With the development of the new ISO 16063/XX series of standards, ISO/TC 108 responded to the need for upgraded standard calibration methods applicable to

- key comparisons on the CIPM and RMO levels in the field of vibration and shock acceleration measurements
- the reliable and uniform specification of the Calibration and Measurement Capabilities (CMCs) in the field of vibration/acceleration, published in the BIPM key comparison database (cf. Appendix C of the Mutual Recognition Arrangement MRA) - nearly all NMIs claim their CMCs in the field of vibration/acceleration to be in compliance with the relevant ISO standards
- the establishment of traceability chains in the field of vibration (measurands: acceleration and derived motion quantities).

After the 2nd meeting of the CCAUV, the annual meeting of ISO/TC 108/SC 3 took place (held in Paris from October 8 to 12, 2001) and the next meeting (to be held in Tokyo, November 2002) is being prepared. Such annual meetings of the TC 108/SC 3 mark the milestones in the processes of developing upgraded and new standards in the relevant area. Between the meetings, intensive work has been done by the project leaders of the current standardization projects and by the experts responding to the draft standards when circulating for comments and/or voting. In this way, remarkable progress has been achieved since the 2nd CCAUV meeting which took place in October 2001.

2 Standards and standardization projects significant for key comparisons and traceability

In Doc. CCAUV-01/05, a survey of the standards and standardization projects was given focusing on the specification of calibration methods needed at different levels of a traceability chain for the field of vibration and shock: methods for primary vibration calibration, secondary vibration calibration, primary shock calibration and secondary shock calibration. The survey focused on

- Standards confirmed after review
- Standards withdrawn
- Standards issued (after revision)
- Standards currently under revision, and
- Standards proposed for revision (zero-stage project)

The current state is demonstrated in Figure 1, and the progress achieved since the 2nd CCAUV meeting is briefly described in the following.

- (a) *ISO 16063-12: Methods for the calibration of vibration and shock transducers – Part 12: Primary vibration calibration by the reciprocity method*

Issued as international standard in 2002: ISO 16063-12:2002

- (b) *ISO 16063-13: Methods for the calibration of vibration and shock transducers – Part 13: Primary shock calibration by laser interferometry*

Issued as international standard in December 2001: ISO 16063-13:2001

- (c) *ISO 16063-14: Methods for the calibration of vibration and shock transducers – Part 14: Primary calibration by high impact shocks*

The zero stage project was confirmed at the SC 3 Meeting in Paris, October 2001. A Working Draft submitted in 2001 is scheduled for discussion at the SC 3 Meeting in Tokyo, November 2002.

- (d) *ISO 16063-15: Methods for the calibration of vibration and shock transducers – Part 15: Primary vibration calibration of angular transducers using laser interferometry*

The zero stage project was confirmed at the SC 3 Meeting in Paris, October 2001. A First Working Draft is under development, and is to be discussed at the SC 3 Meeting in Tokyo, November 2002.

- (e) *ISO 16063-21: Methods for the calibration of vibration and shock transducers – Part 21: Vibration calibration by comparison to a reference transducer*

The ISO/Draft International Standard was amended at the SC 3 Meeting in Paris, October 2001. It became the Final Draft International Standard, which is to be discussed in at the SC 3 Meeting in Tokyo, November 2002.

- (f) *ISO 16063-22 Methods for the calibration of vibration and shock transducers – Part 22: Shock calibration by comparison to an acceleration, velocity, or force transducer*

The Third ISO/Working Draft was amended at the SC 3 Meeting in Paris, October 2001. It became the First ISO/Committee Draft, to be discussed in at the SC 3 Meeting in Tokyo, November 2002.

- (g) *ISO 16063-23: Methods for the calibration of vibration and shock transducers – Part 23: Angular vibration calibration by comparison to reference transducers*

The zero stage project was confirmed at the SC 3 Meeting in Paris, October 2001.

- (h) *ISO 16063-31: Methods for the calibration of vibration and shock transducers – Part 31: Testing of transverse vibration sensitivity*

A Revision of ISO 5347-11:1993 was proposed as New Work Item (NWI) at the SC 3 Meeting in Paris, October 2001 (zero stage project).

3 Conclusions

ISO has responded timely and efficiently to the increased need for standard methods for the calibration of vibration and shock transducers required to ensure international traceability to the SI units in the field of measurements of accelerations and derived motion quantities. The results presented in section 2 demonstrate the remarkable progress achieved since the 2nd CCAUV meeting which took place in October 2001.

With the new work items for *vibration calibration of angular transducers using laser interferometry* (to become *ISO 16063-15*) and for *angular vibration calibration by comparison* (to become *ISO 16063-23*), the first step is taken to extend the series of standard methods for the calibration of vibration and shock transducers, restricted so far to rectilinear motion, to the rotational motion quantities of angular acceleration, angular velocity and rotation angle. The approach to develop in parallel the primary and secondary calibration methods for linear and angular transducers aims at responding in time to the increased need for establishing international traceability in the measurements of translational and rotational motion quantities. Moreover, the Revision of ISO 5357-3:1993 “Secondary vibration calibration” has extended the scope (cf. new title of ISO 16063-21: “Vibration calibration by comparison to a reference transducer”) to include calibrations at lower levels of the traceability chain, down to calibrations under field conditions.

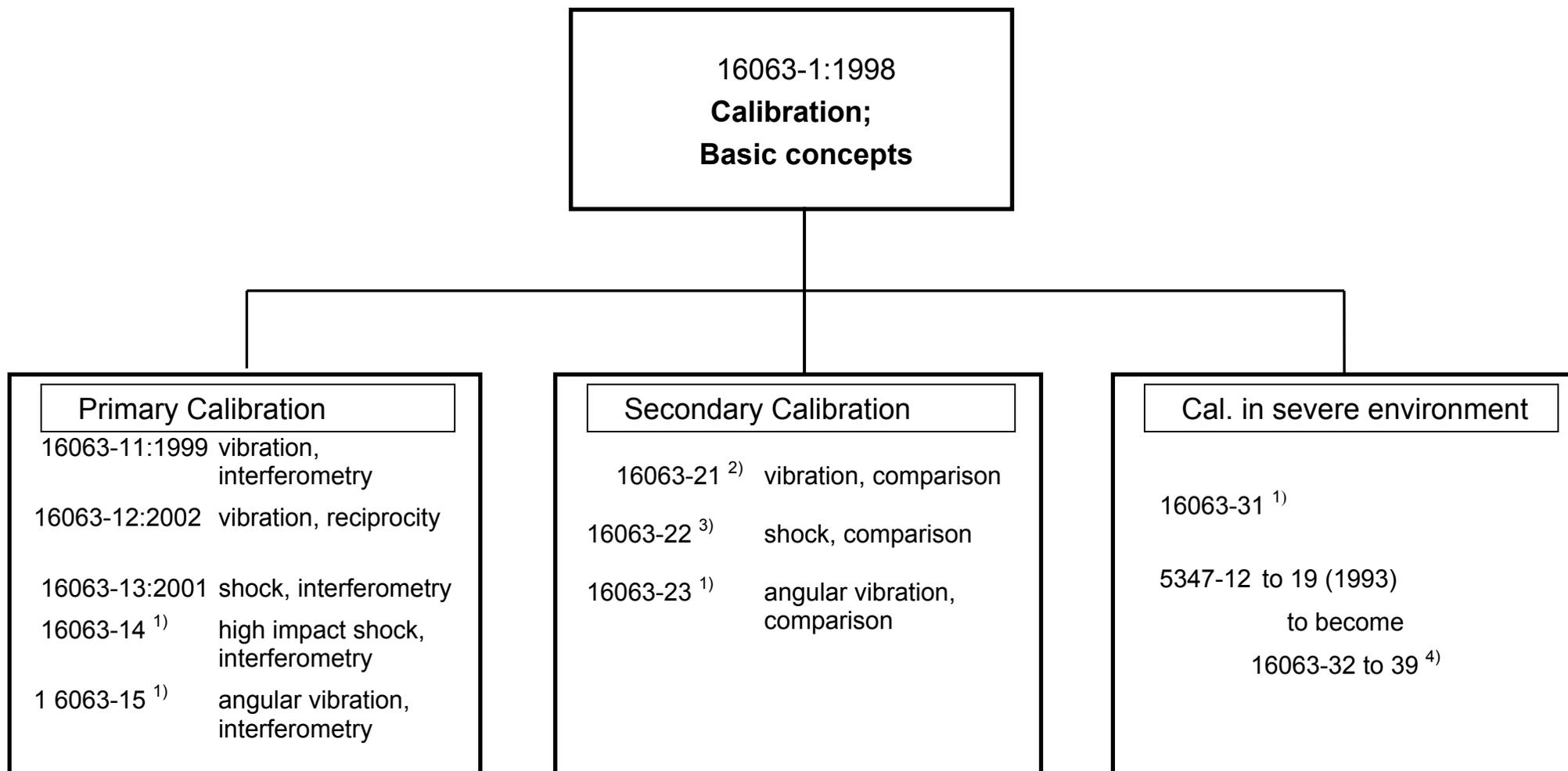
For key comparisons at the CIPM and RMO levels in the field of vibration and shock measurements (quantity of acceleration), the methods for primary vibration calibration by laser interferometry, as specified in ISO 16063-11:1999, are of greatest importance. All 12 NMIs participating in the CIPM Key Comparison CCAUV.V-K1 applied this new international standard in accordance with the Technical Protocol (dated December 15, 1999). All of them have profited, among other things, from the procedures specified for the uncertainty evaluation of the accelerometer calibrations by laser interferometry in accordance with the *Guide to the expression of uncertainty in measurement*. Moreover, some laboratories have made use of the newly specified “sine-approximation method” which enabled them to keep the acceleration amplitude constant (for example, at the preferred amplitude of 100 m/s²) while changing the frequency up to 5 kHz. Based on ISO 16063-11:1999, the key comparison CCAUV.V-K1 furnished key comparison reference values with low uncertainty

(relative standard uncertainty $<1 \times 10^{-3}$) as well as degrees of equivalence which proved the high-level measurement capabilities of the participating laboratories (cf. Draft B report of July 15, 2002). To disseminate the key comparison reference values to the regional metrology organizations (RMOs)), the forthcoming regional key comparisons (e.g. EUROMET.AUV.V-K1) will be based on ISO 16063-11:1999, too.

The activities of BIPM and CCAUV concerning key comparisons and the ensuring of traceability in the field of vibration and shock acceleration have been acknowledged by Sub-Committee TC 108/ SC 3 and by the Chairman of Technical Committee TC 108, Dr. Bruce Douglas (USA). TC 108/SC 3 is in particular interested in ensuring that CIPM and RMO key comparisons for vibration and shock measurements are carried out using adequate methods described for the calibration of vibration and shock transducers specified in ISO 16063.

Figure 1: New ISO standards and standardization projects

"Methods for the calibration of vibration and shock transducers" (state as of September 2002)



Current stages (Sept. 2002):
-39 after revision

¹⁾ zero stage project, ²⁾ Final Draft International Standard (FDIS), ³⁾ Committee Draft, ⁴⁾ edit. 1993 confirmed, to become ISO 16063-32 to