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Report

Visualization Activities in Indonesia

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***Abstract*:** Though it is still in its initial state, visualization techniques as one of the supportive components in the industrial transformation as well as a research tool have, however, gained some supports in universities and research institutes. This paper presents a review of activities related to the visualization research and application in universities and research institutes in Indonesia, namely at the Center for Applied Physics - Indonesia Institute for Sciences (P3FT-LIPI), University of Indonesia (UI), Institute of Technology Surabaya (ITS), Institute of Technology Bandung (ITB), and Aero-Gas Dynamics and Vibration Laboratory (LAGG-BPP-Teknologi).

***Keywords*:** visualization, research institutes, universities.

1. Introduction

Indonesia is the biggest archipelago nation in the world comprises of more than 13000 islands of which approximately 3000 are inhabited spread over an expanse of 6.8 million square kilometers. Lack of integrated transportation system and infrastructure due to this geographical condition will hamper the progress of national development. The urgency of developing the national transportation system and its infrastructure has led the government to put this sector as one of the strategic vehicle for national industrial transformation. In support of this policy, the government has established the Center for the Development of Science and Technology (Puspiptek) - an industrial technology estate comprises of more than 15 industrial supportive laboratories (Habibie, 1982).

The increasing concern on the rapid globalization and the substantial roles of technology in the industrial transformation in Indonesia have prompted many industries, research institutes and universities to review their activities on the technology assessment and application. Nonetheless the role of visualization technology is seen as one of the important supportive components in the effort of increasing the local content of technology.

Several prominent Indonesian universities as well as research institutes, though still in its initial state, have practically started their research program on the implementation of visualization technique for a mere research and industrial purposes. This paper is aimed at reviewing the state of the activities at several places.

2. Visualization Activities in Indonesia

2.1 R & D Center for Applied Physics-Indonesia Institute for Sciences (P3FT-LIPI)

At P3FT-LIPI either in Serpong or in Bandung, researches are mostly focused on material science. Semiconductor laboratory is involving in growing silicon single crystal using Czochralsky pulling technique (Ginting et al., 1996). The silicon melts in Quartz crucible at 1420℃. The flow of the liquid inside the crucible during the growing process is very important to know the rate of distribution of the dopants that is introduced to melt and to control the silicon characteristics. Wood Laboratory is studying the wood characteristic as the fire resistant. In this case, the visualization and mapping of the heat distribution during the heating experiment are also done (Subyakto et al., 1998). The Ceramics laboratory is also involving in the visualization field, especially in the sintering process and the distribution of the chemical components on the sample as a function of the temperature.

2.2 The University of Indonesia (UI)

The University of Indonesia especially the Computer Science faculty has many simulation softwares, computer graphics and numerical modeling researchers. Visualization research is particularly performed as a part of numerical simulation, such as the application of computer system for the classification of multi channel video imageries, and progressive visualization of images for quick recognition (Manurung et al., 1998). The World Bank has awarded a Research Grant to this faculty for developing its human resources as well as its laboratories (Kusnowo, 1998).

2.3 Institute of Technology Surabaya (ITS)

At ITS, the Physics and also the Computer Science Departments are also known to be active in the visualization research. The Computer Science Department has been starting the graduate study program jointly with one of universities in UK. The research activities done in the Physics Department are basically the same as those in P3FT-LIPI, while reserch activities in the Computer Science Department are also basically the same as those in the Computer Science Faculty at the UI.

2.4 Institute of Technology Bandung (ITB)

ITB is one of the famous engineering universities in Indonesia. Most of the IPTN employees are also from ITB alumni. Also some of the professors from ITB occupy very important positions at IPTN. Research activities on visualization are carried out at the Departments of Physics, Applied Physics, and Aeronautical Engineering and Machinery.

2.5 The Aero-Gas Dynamics and Vibration Laboratory (LAGG, BPP-Teknologi)

This laboratory is one of the research centers under the Agency for the Assessment and Application of Technology (BPP Teknologi). Its main function is to support the national aircraft industry and maritime. One of its facilities is the Indonesian Low Speed Tunnel (ILST). The ILST is an industrial and closed circuit wind tunnel with a working section of 3×4 m. Its nominal speed is 110 mps. Its capability for non-aeronautic testing purposes was also considered during the design phase.

The ILST has been regularly utilized for aircraft developments taken place at the Indonesian Aircraft Industries. Three aircraft models namely the configuration of the basic and development of CN-235, the basic and development of N-250 and the preliminary design of N-2130 have been heavily investigated since the ILST was initially operated in 1987.

Generally, the aerodynamic forces of aircraft model tested are measured in the wind tunnel. The forces can be post processes from the static pressure measured on the surface of the airfoil of the model. It can also be directly acquired from the balance installed in the model (internal balance) or off the model (external balance).

Detailed phenomena such as separation, skin friction, flow pattern and transition location, to say a few, are needed, in addition to aerodynamic forces, to provide a clear picture of flow pattern on the surface of the model. In the laboratory wind tunnel, because of the scale problem, the transition from laminar into turbulent on the surface of the model shifts at the location between the leading and trailing edges. The separation, on the other hand, may be related to the pressure gradient. The junction between the wing and the fuselage often produces a large separation directly associates with the large contribution into the drag. On the surface of the airfoil model, the laminar separation corresponds to the transition from laminar to turbulence.

Smoke visualization is the oldest flow visualization technique. Recent reviews on wind tunnel testing activities show that this technique is and will remain as an important experimental tool in the study of complex flow phenomena. Although one can use an NPL-type self-made smoke generator, it is rarely utilized on the regular industrial type of testing. This is caused by the fact that the oily smoke dirties the tunnel. Improvements in generation of an injection of smoke and lighting (laser as light source), as well as data processing (the use of computers) have continued to increase the scientific value of this method.

Tuft technique is the most frequently used in this tunnel. This technique is employed to observe separation on the wing and flap surfaces and on the wing-body junction. Theoretically there are three techniques which belong to tuft visualization techniques: surface, depth and grid tufts. The first one is the most often used. The tuft is made of an ordinary yarn of 3 - 5 cm lengths and of 0.01 to 0.1 mm thick so that it will easily align with local surface flows. In brief, use of thinner tuft in the order of 0.01 to 0.1 mm is recommended. Practical experience shows that careful attention during handling may keep the thickness of diameter of tufts as thick as 0.05 mm. Furthermore, coating them with fluorescent dye does not change tufts flexibility and thickness.

The sublimation technique is primarily used for visualizing boundary layer transition. In this case, a solution mixed of Freon 113 or Acetone with naphthalene is spray painted onto the wing model surface using dried air spray gun. The naphthalene will evaporate depending on the boundary-layer friction. For evaporation of naphthalene is in proportion to the friction in laminar and in turbulent flow, the naphthalene in the turbulent region and in the leading edge disappears and in the laminar one remains. The common practice at ILST is that 6 grams naphthalene is mixed with 1-liter acetone or Freon 113. As long as practical experience is concerned, this gives the best pattern of transition.

Oil flow technique is sometime used to determine transition point. However, a fluorescent oil technique can produce good spatial resolution of flow separation observed. A mixture of kerosene of MARCOL 50 Esso and paraffin is the type of material that is frequently used in our tunnel. The blend is brushed onto the surface of the model before wind-on. During a run, while the light is turned off, the model is radiated with ultraviolet light. The result of oil fluorescent can then be observed significantly.

Representative results of flow visualization commonly practiced at ILST are shown in the following figures. Figure 1 shows mini tuft technique utilized to clarify flow on the wing-body junction. Figure 2 represents pattern of flow on the tail section where oil fluorescent technique has been used. Figure 3 depicts tuft flow visualization result of the port side. And, Figure 4 represents the result of sublimation technique to characterize the transition

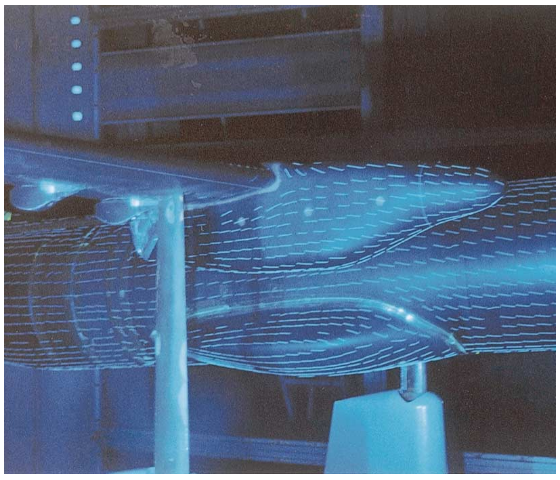

Fig. 1. Mini tufts technique utilized to clarify flow on the wing-body junction (Courtesy of IPTN).

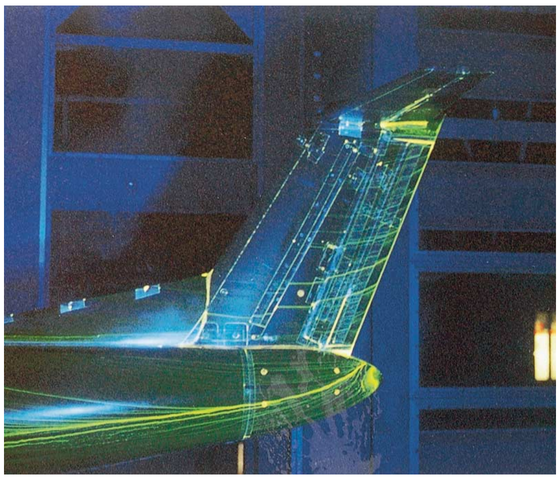

Fig. 2. Pattern of flow on the tail section using oil fluorescent technique (Courtesy of IPTN).

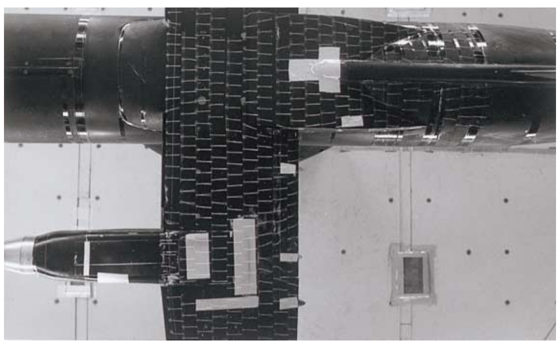

Fig. 3. Tuft flow visualization result of the port side.

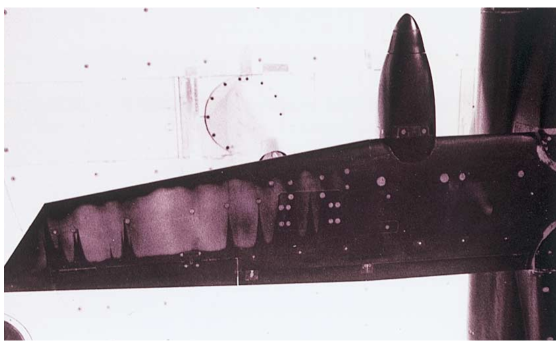

Fig. 4. The result of sublimation technique (Courtesy of IPTN).

location on the wing surface of the model.

3. Concluding Remarks

Some of the visualization activities at several universities and research institutes in Indonesia have been reviewed. Although the activities have not been wide spread in many of research institutes or universities, the visualization is foreseen as one of the supportive components in enhancing the effort of added value process. The economic situation recently seems to slightly decelerate its development in Indonesia.

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Author Profile

Masno Ginting: He finished his undergraduate degree at Universitas Sumatra Utara (USU) in 1983. He obtained his M.Sc. degree in 1988 and his Ph.D. degree in 1992 at University of Waterloo, Ontario-Canada. His graduate works involves the growing single crystal and thin films semiconductor for solar cell materials. In 1993 he returned to Indonesia and work at R&D for Applied Physics-Indonesian Institute for Sciences as senior researcher, and continuously working in growing thin films and single crystal semiconductor. In 1996 he was appointed as the head of the semiconductor laboratory at the same institute. In 1998 he took his Postdoctoral work at Korean Institute of Energy Research (KIER). Recently he already achieved the highest research degree in Indonesia (APU degree which is identical with professor). He is a member of Indonesian Physical Society and also the member of National Research Council of Indonesia for the period of 1999 - 2004.

Andi Eka Sakya: He directly joined the Aero-Gas Dynamics and Vibration Laboratory - the Agency for the Assessment and Application of Technology (LAGG-BPPT) after finishing his study at the Department of Physics of Institute Technology Bandung in 1982. He received his Master and Doctorate Degrees from the Department of Aeronautical Engineering, Nagoya University in Japan in 1991 and 1994, respectively. He has been appointed as the Head of Division for Research and Development of LAGG-BPPT since 1994.

Anung Kusnowo : He finished his first degree in Physics, Institute Technology Bandung (ITB) in 1974, Master Degree at Brunel University UK in 1977 and Doctorate degree in sandwich program of University Indonesia (UI) and Tokyo Institute of Technology (TIT) in 1985. Since 1971 he was working in Indonesian Institute of Sciences (LIPI). From 1996-1998 he was director of R&D Center for Applied Physics, since 1998 as Deputy Chairman for General Affair. He is serving as Chairman of Indonesian Physical Society from 1996-2000.