

**Report of the Peer Review, Aerospace Engineering Department
Indian Institute of Technology, Bombay
(Review held 4th March 2014)**

A. Introduction

On 4th March 2014 a Peer Review was organized at Aerospace Department to conduct a comprehensive review of the Department's activities with specific focus on:

- (i) To verify the coverage of important aerospace areas in the Department
- (ii) To assess how much the Department fulfills its envisaged roles.
- (iii) Relevance of course programmes and research
- (iv) The quality and quantity of research carried out as applicable to aerospace
- (v) The teaching / learning methodologies employed in the theory and lab courses
- (vi) The depth and breadth of sponsored projects undertaken
- (vii) The vibrancy and depth of industry engagement.
- (viii) The infrastructure and research facilities in the department.

The following members participated in the Review

1. Dr. B. N. Suresh,
Vikram Sarabhai Distinguished Professor
ISRO HQ, Antriksh Bhavan
Bangalore – 560 231

3. Dr. Santhosh Koruthu,
Scientist 'G',
Aeronautical Development Agency(ADA)
Bangalore

B. Review Process

Peer Review (PR) of the Aerospace Department of IIT-Bombay was held on 4th March 2014. It started in the morning at 10.00 hrs and continued till 18.00hrs in the evening. The following are the major presentations and discussions.

- a. Detailed presentation on Department activities by HoD, and discussions
- b. Brief presentation by Faculty members on their research tasks
- c. Interaction with UG, PG and doctoral research students

Subsequent to the review, the PR committee members continued to be in touch with the Department faculty over e-mail. Information requested by the PR committee member/s was provided by the faculty, specifically regarding the contents of various courses.

C. Introductory Remarks & Presentation by HoD

Prof SD Sharma, Head of the Department, gave a brief outline of the review planned and introduced all the faculty members. Subsequent to that HoD made a detailed presentation on various aspects of the work of the Department. Starting from the vision and mission

statements, the presentation covered most aspects related to the Department's activities: the curricula, distribution of courses and credits for different programs, the core courses and the electives offered, the research activities under each faculty member, various statistics related to the distribution of students under various programs over the years under review, the facilities available in the Department, teaching feedback from students, sponsored projects, consultancy projects, collaborative research, publications, large facilities being set up, entrepreneurship promotional activities etc., with active participation from faculty during discussion on the topics covered in the presentation.

D. Research Presentation by Faculty Members

Subsequent to HOD presentation individual faculty members presented highlights of their research work and teaching activities. The research areas are quite relevant to the aerospace activities and generally of very high quality.

E. Department and Faculty

Presently the Department has 23 faculty members which includes 5 re-employed after superannuation and one on contract. The Department has competent faculty who are strong in their respective fields. All of them have excellent academic records. Many of them have received various distinctions and awards. Faculty expertise is spread over aerodynamics, structural mechanics, flight mechanics, control, propulsion and design. The student to faculty ratio in IITs is expected to be ideally around 15:1. Currently in the Department, it is over 19:1.

F. Academics and Research

The academic and research activities in the Department are on a satisfactory growth curve. The Department has scored well, on an average over the last five years, in student evaluations of the teaching in the Department. The scores have been consistently high. The academic rehabilitation program and the mentorship program seem to have been well implemented and appear to have helped the students. There are courses for improving technical communication skills. Weekly seminars by research students seem to have made the research environment more vibrant. The number of publications and citations has remained at a satisfactory level for the Department as a whole. There is a strong group involved in research on MAV's. Research students seemed in general more than satisfied with their research programmes. The publication record of the Department is generally good. The Department has also carried out many collaborative research projects with both prominent National and International Institutions.

The Committee generally felt that the academic activities and research being pursued in the Department are quite satisfactory. The Department has succeeded in developing high quality human resources in the area of aerospace science and technology and some of the students are opting to join aerospace organizations in the country. Department may encourage the faculty members to have wider interaction and closer participation in many of the national projects or in the initiatives of private or public sector industry.

G. Industry interface and Consultancy

The Department is actively involved in collaborative or sponsored projects and many of the research programs pursued in the department are funded by government agencies such as ARDB and DST, government organizations such as ISRO, DRDO, HAL, BARC and ADA, as

well as private industries like L&T, Pratt & Whitney, Siemens Energy Inc., etc. The department has contributed reasonably well to the national programs like the LCA, IGMDP, GSLV, etc. by participating actively in their reviews. They have also invited eminent scientists from Aerospace Industries as guest faculties. The Department has made significant contributions in the area of systems engineering particularly in imparting the knowledge in system analysis and multi-disciplinary optimization. In the last 5 years the Department is handling on the average about 40 sponsored Projects and about 15 Consultancy Projects. The sponsored research, especially using funds from private companies, appears to be limited.

The Department has taken keen initiative in entrepreneurship activities. Although it is small in number its faculty members have co-founded two companies – Zeus Numerix Pvt. Ltd. and FEAST Software Pvt. Ltd. which are doing quite well.

H. The Infrastructure and Research facilities

The Department has well established Research Laboratories in aerospace activities. Presently it has 7 aerodynamics and design labs, 3 structural labs, 3 propulsion labs and 2 dynamics & control labs. Research facilities include a number of wind tunnel facilities, shock tunnel for hypersonic research, lighter than air (LTA) lab, UAVs, MAVs simulators etc. Presently there is no clear demarcation of the teaching and research laboratories. This has happened due to sudden increase in the intake of students in the recent past. This area needs serious attention.

I. Interactions with Students

Detailed interaction was held with the entire spectrum of students involving undergraduate, graduate and doctoral students. The students expressed their views on the curricula, the courses taught, the facilities available for graduate studies including research, the placement opportunities and constraints etc. The interaction was very productive and some of the very salient points which emerged during the discussions are summarised below. These areas certainly require further attention.

- a) Students generally felt that more core aerospace companies are not coming for placements.
- b) Interaction with Industries can be improved. More encouragement may be there for internships at relevant aerospace industries.
- c) The curriculum may have a better match with the job requirements. Some courses seem to be very intense while some others do not have the same intensity. Content wise, some courses seem to repeat much of the prerequisite courses.
- d) In some courses the concerned faculty member/s, seem to be using modern teaching aids and students felt that the right combination of blackboard and modern teaching aids would help them to have better learning.
- e) For many courses, evaluation of answer papers seems to be done by the Teaching Assistants. Some of the students expressed concern over the evaluation process where the final answer is only given full importance.
- f) Flight training for the students has not happened for many years. It appears that lack of interest in flight training among the majority of the students seems to be the reason.
- g) Research students involved in experimental work face difficulties in terms of workshop / fabrication facilities. The overall policy of reducing the manpower in workshops has contributed to this situation.
- h) The options available for the elective Courses are limited. This is due to the

shortage of faculty members.

- i) For Ph.D students a course on research methodology may be introduced.

J. General Observations

The Committee generally felt that the academic activities and research being pursued in the Department are quite satisfactory. The curriculum and the subjects offered are relevant to aerospace activities. Students are generally happy with the Department although they have expressed certain difficulties in some of the specific areas which have been already highlighted. The Department has succeeded in developing high quality human resources in the area of aerospace science and technology and at least some of them are opting to join prominent aerospace organizations in the country. The shortage in the faculty positions in the Department is quite visible. This will have a serious impact on the research activities of the Department. Presently there is participation of the Departmental faculty members in some of the national aerospace programmes. However wider interaction and much closer participation in the aerospace projects of the Country and also in the initiatives of private or public sector industry, would not only raise the profile of the Department but also help the faculty members who are doing advanced research to make their own distinctive contributions.

K. Recommendations

1. There is an urgent need to improve the student faculty ratio in the Department. Though the Department seems to be making some efforts to attract eminent researchers, all the faculty positions available in the Department are not filled. The Department needs to make a concerted effort to fill up these positions.
2. The Institute needs to evolve a policy towards attracting eminent researchers for short term positions in the Institute. Enhancing the pay and facilities considerably for these limited term assignments could be an option.
3. Presently the laboratory and research facilities are mixed. The research facilities need to be clearly demarcated as far as possible. The facility enhancement should be in proportion to the increase in the number of students.
4. A standing committee, consisting of members of the faculty will be very useful, for curriculum updates. Updates can utilize the student feedback. Inputs may also be sought from major aerospace Organisations of the Country.
5. Various feedback received during the student interaction session may be reviewed for appropriate solution. For example many students seem to be willing to take part in sponsored project work. The faculty needs to explore how to streamline the sponsored project work.
6. Use of Information Technology may be enhanced: a communication highway connecting premier research institutions and academic institutions for easy access of research information, database of faculty, present and previous students and their research topics, repository of weekly presentations / specialist presentations / lectures by eminent people etc. The recent initiative of the Department in digitizing the departmental library is a welcome step.
7. The Department may consider organizing additional Honours courses to cater to specific requirements of major employers. While the organization of the courses has to be strictly within the purview of the Department, it should also meet the needs of general job profiles.
8. Trained human resource in the area of flight dynamics and control is a strong felt need in most of the national aerospace laboratories. The Department may

consider strengthening this area by establishing a strong research and teaching programme, possibly in collaboration with faculty in the Electrical Sciences and other aerospace laboratories of the Country.

9. A smaller programme, more oriented to design and development of complete systems, may be established in collaboration with aerospace agencies and industry to give better exposure to the significant number of students who join industry. This also brings in closer interaction with national aerospace laboratories.

(Dr. Santhosh Koruthu)

(Dr. B. N. Suresh)