

昭和61年5月27日

日本学術振興会 人物交流課  
外国人招へい研究者係御中

受入研究者 東北大学高速力学研究所  
所属・職 所長・教授  
氏名 伊藤 英寛

外国人招へい研究者Acosta, A. J. 氏の  
下記関係書類をお届け致します。

1. 研究経過報告書

様式 8-1

様式 8-2

様式 8-3

様式 8-4

様式 9

以上

昭和61年5月27日

## 研究経過報告書

受入研究者 東北大学高速力学  
 所属・職 研究所 所長 教授

氏名 伊藤英覚

外国人招へい研究者の研究経過について下記のとおり  
 報告します。

## 記

1. 外国人招へい研究者職・氏名	California Institute of Technology, Professor Allan J. Acosta
2. 研究課題名 (英訳名)	Studies on Cavitation and Fluid Machinery
3. 期間	昭和61年3月23日 ~ 昭和61年4月26日 (35日間)
4. 主な研究協力者職・氏名	東京大学工学部 教授 大橋秀雄
5. 主として利用した宿泊施設(所在地)	仙台第2ワシントンホテル (仙台市大町) 2-2-10

(注) 4枚セットで提出のこと。招へい研究者が作成した Research Report (様式10)とあわせて、招へい期間満了後1か月以内に提出のこと。



6. 滞在中の日程		
月日	訪問先名称・訪問内容(研究指導・講演・視察等)・移動方法	宿泊場所
3/23	大阪国際空港着(航空機 JAL 61)	辻本宅(大阪)
3/24	大阪発,東京着(新幹線,新大阪-東京)	東京ガーデンパルス
3/25	日本学術振興会訪問(滞在費受領)	同上
3/26	東京発,仙白着(新幹線,上野-仙台)	仙台オマニフン トンホテル
3/27	東北大学高速力学研究所訪問(視察並びに研究懇談)	同上
3/28	航空宇宙技術研究所角田支所訪問(視察並びに講演)	同上
	宇宙開発事業団角田ロケット開発センター訪問(視察)	
3/31	仙台発,東京着(新幹線,仙台-上野)	東京ガーデンパルス
4/1	日本機械学会才63期通常総会講演会出席	同上
4/2	日本機械学会才63期通常総会講演会出席並びに特別講演	同上
4/3	東京発,福岡着(航空機 JAL 359)	博多郡ホテル
	九州大学応用力学研究所並びに九州大学生産科学 研究所訪問(視察)	
4/4	九州大学工学部訪問(視察)	同上
4/5	博多発,小倉着(新幹線,博多-小倉)	ホテル ニュー田川
	九州工業大学訪問(視察並びに研究懇談)	
	小倉発,広島着(新幹線,小倉-広島)	広島 サンテラスホテル
4/6	広島工業大学訪問(視察)	同上
4/7	広島大学工学部訪問(視察)	同上
	広島工業大学にて学術講演	
4/8	広島発,新大阪着(新幹線,広島-新大阪)	大阪ロイヤル ホテル
	大阪大学基礎工学部訪問(研究指導並びに視察)	
4/9	三菱重工(株)高砂研究所訪問(講演と視察)	同上
4/10	大阪発,京都着(車)	京大会館
4/11	京都大学工学部訪問(視察並びに研究懇談)	同上





7. 研究指導、研究協力等実施の状況とその成果
3月27日、東北大学高速力学研究所の視察を行うとともに、同研究所とカリフォルニア工科大学における最新の研究の情報交換を行い、今後の流体機械の高速化に伴う諸現象のための研究進展に対する助言を得た。
3月28日、航空宇宙技術研究所角田支所において「遠心ポンプ羽根車の小れ回り流体力」について講演を行い、小れ回り流体力に関する研究の重要性について理解を深くした。
4月2日、日本機械学会第63期通常総会において「アメリカにおける機械工学の教育と研究の現状」と題する特別講演を行うとともに、講演会参加者と日米両国の機械工学の教育・研究に関して討論を行い、教育・研究問題に関する相互の理解を深めた。
4月3日～4日、九州大学の応用力学研究所、生産科学研究所および工学部において流れの可視化技術、ターボ機械の内却流れ、キャビテーション、二相流等の研究視察を行うとともに、これらの研究に対する討論において、特に各種流体機械内の流れに関する研究について多くの有益な助言を得た。
4月5日、九州工業大学においてポンプ・水車や固気二相流の研究視察を行うとともに、ポンプの過渡特性等について討議を行うことにより、今後の研究問題に関する多くの助言を得た。特に、非定常流研究へのアプローチに関して参考となることが多かった。
4月6日は広島工業大学、4月7日は広島大学工学部において、それぞれ流体力学実験室および水力実験室を視察するとともに、関係教官との懇談を行った。さらに、4月7日広島工業大学において「遠心羽根車に関する回転力」と題する学術講演を行い、活発な討論が行われた。
4月8日、大阪大学基礎工学部において共同研究中の遠心羽根車の小

れ回り安定性の研究について、詳細にわたり討論を行い、今後の研究方針についての研究指導を行った。

4月12日、京都大学工学部において「キャビテーションとその初生」について特別講演を行い、今後の標題に関する研究の方向性について財言を得た。

4月14~15日名古屋大学工学部において、回転場の境界層、気泡吸入時ポンプ特性の実験について各種のコメントを頂いた。また、ポンプ回転時の圧力分布、ポンプ内の気泡運動の理論について指導を受けた。

4月16日、キャビテーション国際シンポジウムにおいて「最近のキャビテーション初生研究における問題点について」と題する招待講演を行った。その結果、各国参加者のキャビテーション初生に関する研究についての理解を深めた。

4月22日、北海道大学工学部において「キャビテーションおよびキャビテーション初生」についての特別講演を行い、活発な討論が行われた。

4月23日、東京大学工学部において「キャビテーション研究の最近の動向」について特別講演を行い、参加者のキャビテーションについての理解を深めた。

4月24日、東京大学工学部機械工学科、船舶工学科の実験室の視察を行うとともに、両学科の大学院生の研究指導を行った。その結果、学生の流体工学に関する教育に成果があった。

4月25日、株式会社日立製作所機械研究所の視察を行うとともに、「ふれまわって回転する羽根車に働く流体力」について特別講演を行った。





THE JSPS FELLOWSHIP FOR RESEARCH  
IN JAPAN

RESEARCH REPORT

Date 15 May 1986

Reported by: Allan J. Acosta

Host Scientist: Professor H. Ito, Inst. High Speed Mech., Tohoku Univ.

Research Period: From March 23, 1986 To April 26, 1986

Title of Research in Japan:

Studies on Cavitation and Fluid Machinery

(Signature)

Allan J. Acosta



RESEARCH REPORT  
Allan J. Acosta  
JSME Fellow Mar 22-April 27, 1986

1a. Itinerary:

- . Mar 22 depart LAX for Japan
- . " 23 arrive Osaka (Dr. Y. Tsujimoto)
- . " 24 depart " for Tokyo (Prof. H. Ohashi )
- . " 26 " Tokyo " Sendai (Prof. A. Shima )
- . " 27 visit Institute of High Speed Mechanics (Profs Ito, Shima)
- . " 28 " National Aerospace Laboratory-Kakuda (Dir. Suzuki, Dr. Kamijo)
- . " 31 depart Sendai for Tokyo (Prof H. Ohashi )
- . April 1 attend JSME meeting in Tokyo
- . " 2 give special lecture at JSME meeting (Prof H. Ohashi Chair.)
- . " 3 depart Tokyo for Fukuoka (Prof Y. Senoo )  
visit Res. Inst. Industrial Science
- . " 4 visit University of Kyushu (Prof Takematsu )
- . " 5 depart Hakata for Kokura (Prof Matsunaga, President  
Inoue, Prof Nishi, Assoc Prof Tsukamoto all at K.I.T.)
- . " 6 depart for Hiroshima (Prof. Murai )
- . " 7 visit Hiroshima Inst. Technology-special lecture (Prof Murai )
- . " 8 depart Hiroshima for Osaka (Dr. Y. Tsujimoto )
- . " 9 visit Mitsubishi Heavy Ind. Takasago Laboratories-special talk
- . " 10 depart Osaka by car for Kyoto (Prof. Akamatsu )
- . " 11 visit Univ. of Kyoto (Prof. Akamatsu, Assoc Prof Fujikawa )
- . " 12 special lecture U. Kyoto
- . " 13 depart Kyoto for Nagoya
- . " 14 visit Nagoya University (Prof. Nakamura, Assoc Prof. Minnemura),  
special lecture.
- . " 15 depart Nagoya for Sendai
- . " 16-19 attend International Symposium on Cavitation-give 1st  
invited lecture.
- . " 20 depart Sendai for Sapporo
- . " 21 visit University of Hokkaido (Prof. Kiya, President Arie )
- . " 22 special lecture, Univ. Hokkaido.
- . " 23 depart Sapporo for Tokyo (Prof. Ohashi )  
special lecture, Univ. Tokyo.
- . " 24 visit University of Tokyo (Prof. Ohashi, Assoc. Prof.  
Matsumoto, Prof. H. Kato )
- . " 25 visit Hitachi Research Lab. (Tsuchiura) with Prof. Ohashi;  
special lecture there.
- . " 26 free day
- . " 27 return to LAX via Narita (Assoc. Prof Matsumoto )

Total travel expenses in Japan. All tickets were bought in the United States. These include airfare LAX-Narita & return, four internal flights within Japan, and a 21 day Japan Railpass (green). The total costs amounted to

Transportation cost:        \$2007.14

as of Mar. 07, 1986. There were no additional costs in Japan save for

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incidental taxi/subway etc.

1b. Academic activities. The itinerary above lists each of the technical and university locations of my visit. This factual listing cannot describe all the depth of interaction nor the large number of faculty, students and student research programs at each institution. In all cases my areas of interest are and were in mechanics of fluids with applications to fluid machinery research and to problems of cavitation both basic and applied areas. In every instance on these visits I found a lively interest in my own work here at Caltech and I found that of my Japanese hosts extremely interesting and in several cases the work and instrumentation was quite new to me. My own interest is mainly in experimental problems in fluid mechanics and I found many of my Japanese hosts had a similar point of view. I was able to have many discussions on the teaching of mechanical engineers (the subject of my JSME lecture) and found that both I and my hosts had very similar ideas; these involve both subject matter as well as the use of computers in introductory instruction. The choice of research topics is always a matter of some interest; I found many topics of similarity in our two countries in the choice of research areas-particularly in turbulent flow. There is much more research in Japan on "fluid machinery" I believe than in the US in the university laboratories. This is particularly so for pumps, fans and turbines. And it is also true for centrifugal machinery generally. The three industrial labs all appeared to have resources and equipment in the fluid machinery field the equal of any I know here (although I am not well versed in the gas turbine industry) and the High speed Institute in Sendai is quite unique and does not have an exact equal anywhere to my knowledge.

My academic activities then consisted of lectures, lab visits, and discussions with many mechanical engineering faculty. In addition to those listed in the itinerary, I also visited the new Hiroshima University mechanical engineering laboratory facilities.

1c. Impressions of Japanese Science formed in my visit:

These are varied and mixed somewhat with my overall impressions of the country. But let me say first that these impressions are basically all very positive and indicate to me a very strong & healthy status for engineering research and teaching. I came to this view from several different experiences. First is the High Speed Institute at Sendai which I visited 14 years ago. I was familiar with it then and remain so by its publications. Although the Institute was always very strong academically it seems to have gathered more strength in fundamental work in fluid mechanics and in new areas. The level of sophistication of instrumentation and the availability



of it for experimentation at the Institution was most impressive. And there seemed to be a very good sense of direction and purpose throughout the High Speed Institute.

I found this same sense of purpose and direction in most of the research groups I visited—even in university labs where instrumentation and modern equipment is more scarce. In almost every case in university labs there was over-crowding of experimental facilities; often they were poorly lighted and even untidy. The exceptions to this were all to be found in the newer recently-completed buildings or renovated laboratories having new and major equipment items. In almost all cases, however, the research being carried out by the graduate students and faculty was contemporary with the best work I have seen in the USA or Europe in these fields despite the sometimes crowded conditions of the work.

It was also noticeable that in each experimental set-up there was a dedicated microcomputer data acquisition system or data gathering system based on a departmental minicomputer. Thus by contemporary standards here in the USA this essential component of research is fully available in Japanese Universities and is I believe one of the reasons for the productivity of the university research I saw.

There was another feature of my academic visits I always found pleasant and that was the presentation of graduate student research by the students themselves in English with the guidance of their professor. Many were fluent in English; some were not but tried very hard. In all cases it was good to see their enthusiasm and to have the opportunity to speak with them.

My impressions at the Japanese universities are much the same at my own and other top American and European universities; namely excellent well-motivated students who work hard; they are fluent in computers, designing and building experimental apparatus and have much the same technical motivation for their research as do our own. And they also seem very well prepared academically in broad scientific disciplines so essential now for engineering practice.

My exposure to the practice of engineering was limited to the one governmental lab (NAL-Kakuda), Mitsubishi Heavy Industry lab at Takasago and Hitachi Mechanical Engineering Lab near Narita. All of these were superb facilities, beautifully maintained and best of all wonderfully well equipped with the most modern apparatus in my field and better than I have seen in equivalent companies elsewhere. Several features of these laboratories stood out to me or rather I should say the use of personnel there stood out to me. My reactions were twofold; the first was the lack of narrow specialists in engineering, (everyone had to do everything), and the second similar to the first was that a research engineer expert in one field may be asked to become one or perhaps to lead a group in another quite different field. I can imagine that successful transitions of this sort say 10 years out of university can be quite difficult and put a considerable amount of pressure on both the person involved as well as his management. I had the feeling that engineers in this research environment had to work very hard indeed.

Another feature of work and research in industry new to me was the granting



of external degrees at the doctrate level for work done in industry. I can see the good advantages that can accrue to the person involved as well as to the company; this practice is I believe known in Europe but it is not followed in the USA.

1d. Comments concerning the fellowship program.

I feel extremely fortunate to have been the recipient of a JSPS fellowship; it was a period of great learning in an academic environment rather like my own and so I felt scientifically very welcome and very comfortable psychologically. I can only hope that my many hosts and those to whom I spoke and to the members of the various talks I gave and discussion groups found something of value in my visits. The mechanics of the fellowship itself, i.e., travel arrangements, accomodations, interacting with JSPS in Tokyo were all very smooth and easy. In great part this was due to the meticulous planning of Prof. A. Shima of Tohoku University and to my other hosts, Prof. Murai now of Hiroshima Inst. of Technology and Prof. Ohashi of Tokyo University. Great care was taken so that at no time when I needed help was I without it. This extremely thoughtful and considerate care allowed me to enjoy every minute of my time in Japan and to leave there with the desire to return soon.

My travel tickets were purchased here in the Los Angeles area from a local travel agency SAITO TRAVEL, 530 W 6th Street Suite 519, Los Angeles CA 90014. This Japanese-speaking agency was well informed and served me well. Even though JTB required a discount of 8% for this external purchase it was restful to have control of ticketing done locally and I would recommend this policy again.

1e. Other comments. Should I ever return to Japan I shall endeavour to learn the Katakana/Hiragana phonetic alphabets beforehand so that simple signs can be understood. The lack of being able to use a dictionary is in time rather unsettling to one. This is however about the only thing I did find unsettling in my visit.

1f. General Impressions formed of Japan during my stay.

Like most visitors, especially of my generation, I sense that Japan is a country that has momentum and knows what it wants to do—that is there is a sense of purpose in its development. The impression of industry, discipline, training—all increased. The appreciation of the Japanese esthetic also increased. My impression of a homogeneous people not divided by religion nor strongly divided politically increased. And the importance given to education and new knowledge as the essential key for the future made a great impression on me as does the increasing awareness of the Japanese ability to consult together and to plan important lines of action. The physical beauty of Japan, the tidyness, the unfailing friendliness all make one want to return.

2. A photograph of myself and former president of the Japan Society of Mechanical Engineers on the occasion of my presenting to Prof. Katto a letter of mutual friendship from the president of the American Society of Mechanical Engineers (Prof. L. Fletcher of Texas A&M)



is attached.

AJA *aja*  
May 15, 1986  
Caltech 104-44  
Pasadena, CA 91125 USA

