# 8th International Superconductivity Industry Summit: ISIS-8

(October 12 to 14, 1999, Kyoto International Hotel)

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Ministry of International Trade and Industry

1. Introduction

2. R&D on superconductivity in Japan
   Outline of R&D on superconductivity in major ministries and agencies

3. Outline of R&D on superconductivity in the Ministry of International Trade and Industry
   (1) Present situation and results of current projects

   (2) Plan for future projects in future

4. Closing
   (1) Restructuring of Central Ministries and Agencies

   (2) Establishment of the Ministry of Economy and Industry and Self-supporting Administrative Corporations for national research institutes

[Reference]

① Table 1 FY2000 Budget for Superconductivity-related R&D in Five Ministries and Agencies (Requested Budget)

② Table 2 FY2000 Budget for Superconductivity-related R&D, as Allocated by the Ministry of International Trade and Industry (Requested Budget)

## Table 1 FY2000 Budget for Superconductivity-related R&D in Five Ministries and Agencies (Requested Budget)

(Unit: million yen)

| Item / Name of Ministry or Agency | Themes | FY1999 Budget (Note 1) | FY2000 Requested Budget | Remarks |
|---|---|---|---|---|
| Ministry of International Trade and Industry | R&D on superconducting generators, flywheel electric power storage systems, SMES systems, and basic technologies for superconducting applications | 9,125 | 8,142 | |
| Science and Technology Agency | Multi-core project for superconducting material studies, nuclear fusion, etc. | 2,620 | 2,693 | |
| Ministry of Education | Consolidation of superconductivity-related research and educational systems | 517 | 529 | |
| Ministry of Transport | Subsidy for technical development of superconducting magnetically levitated railroads | 3,550 | 1,434 | |
| Ministry of Posts and Telecommunications | "Research on Ultrahigh Frequency and High-speed Circuit Technology Using Superconducting Devices" as part of the "Research on New Functions and Ultimate Technologies for Information and Communication Devices" program | 108 | 111 | |
| Total | | ~~16,848~~ 15919 | 12,908 | |

Note 1: Initial budget

Note 2: The total may be different from the sum of the budget for each item because all figures have been rounded-off.

## Table 2 FY2000 Budget for Superconductivity-related R&D, as Allocated by the Ministry of International Trade and Industry (Requested Budget)

(Unit: million yen)

| Themes | FY1999 Budget | FY2000 Requested Budget | Remarks |
|---|---|---|---|
| 1. R&D on Superconducting Materials and Devices | 6,645 | 5,704 | |
| ① New Sunshine Program: R&D on basic technologies required for superconductivity applications | 3,389 | 3,107 | Development of basic technologies for manufacturing and processing superconducting materials |
| ② Development of technology for producing superconductors in microgravitational environments | 3,205 | 2,546 | Fabrication of superconducting materials in space |
| ③ Special R&D at national research institutes* | 51 | 51 | Special R&D at Electrotechnical Laboratory |
| 2. Development of Application Technologies for Superconducting Electric Power Systems | 2,441 | 2,408 | |
| ① New Sunshine Program: Application technologies for superconducting electric power systems | 1,498 | 0 | Development of superconducting generators |
| ② New Sunshine Program: R&D on basic technologies for superconducting generators | 0 | 327 | Development of high-density technologies for superconducting generators |
| ③ New Sunshine Program: Preliminary basic research on AC superconducting electric power equipment | 116 | 0 | Preliminary basic research on development of AC superconducting equipment |
| ④ New Sunshine Program: R&D on basic technologies for AC superconducting electric power equipment | 0 | 939 | Development of basic technologies for the manufacturing of AC superconducting equipment |
| ⑤ New Sunshine Program: R&D on high-Tc superconducting flywheel electric power storage systems | 551 | 0 | Development of basic technologies for the practical use of high-Tc superconducting flywheels |
| ⑥ New Sunshine Program: R&D on technologies for superconducting bearings in flywheel electric power storage systems | 0 | 265 | Improvement of characteristics and development of application technologies for superconducting bearings |
| ⑦ Development of technologies for superconducting magnetic energy storage systems | 275 | 877 | Development of technologies for superconducting magnetic energy storage (SMES) systems |
| 3. Investigations concerning superconductivity | 38 | 30 | |
| ① Survey and research on the standardization of superconducting materials | 38 | 30 | Survey and research on the standardization of superconducting materials for new electric power generation systems |
| Total | 9,125 | 8,142 | (89.2% of previous FY) |

Note: The total may be different from the sum of the budget for each item due to round-off system.
* Including a variable allocation

# 8th International Superconductivity

# Industry Summit

# - ISIS-8 -

October 12 – 14, 1999
Kyoto Kokusai Hotel, Kyoto, JAPAN

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ISTEC

# Agenda for the 8th International Superconductivity Industry Summit (ISIS-8)
## October 12 - 14, 1999
## Kyoto Kokusai Hotel, Kyoto, Japan

**October 12 (Tuesday)**

| | |
|---|---|
| 12:00 - 20:00 | Secretariat (Kifune Room) |
| 16:00 - 17:00 | CSAC Meeting (Atago Room #1) |
| 16:00 - 17:00 | CONECTUS Meeting (Atago Room #2) |
| 17:00 - 18:00 | Protocol Meeting (Atago Room) |
| 18:30 - 20:00 | Registration & Reception (Heian Room) |

**October 13 (Wednesday)** Sessions* → Nijou #2
Working Lunch and Dinner → Heian Room

| | |
|---|---|
| 09:00 - 09:50 | **Opening Session**<br>Chairperson: Mr. Masaharu Higuchi (ISTEC, Japan) |
| 09:00 - 09:30 | Welcome & Greetings (ISTEC, CONECTUS & CSAC) |
| 09:30 - 09:50 | Opening Remarks<br>Mr. Takafumi Onishi (Director of Development Program, Policy Planning & Superconductivity, AIST, MITI) |
| 10:00 - 12:30 | **Session 1: Overview of Superconductivity Technologies in EU, Japan & USA**<br>Chairperson: Dr. Hiroshi Kaminosono (CRIEPI, Japan) |

* Simultaneous English/Japanese translation available

| | |
|---|---|
| 10:00 - 10:30 | CONECTUS |
| | • Dr. Dag W. Willen (NKT Research Center, Denmark) |
| | • Dr. Juan Farre (NST A/S, Denmark) |
| | • Dr. Michael Sander (FZK/ CONECTUS, Germany) |
| 10:40 - 10:50 | Discussion |
| 10:50 - 11:30 | CSAC |
| | • Dr. Gregory J. Yurek (ASC) |
| | • Mr. Carl H. Rosner (IGC) |
| | • Dr. Paul M. Grant (EPRI) |
| 11:30 - 11:40 | Discussion |
| 11:40 - 12:20 | ISTEC |
| | • Dr. Tsuneo Nakahara (SEI, Japan) |
| | • Dr. Shoji Tanaka (ISTEC, Japan) |
| 12:20 - 12:30 | Discussion |
| 12:30 - 14:00 | **Working Lunch** |
| 14:00 - 18:00 | **Session 2: Lessons from Venture Corporations** |
| | Chairperson: Dr. Nobuaki Tamagawa (DuPont KK, Japan) |
| 14:00 - 14:30 | CONECTUS |
| | • Dr. Juan Farre (NST A/S, Denmark) |
| 14:30 - 14:40 | Discussion |
| 14:40 - 15:40 | CSAC |
| | • Mr. Carl H. Rosner (Intermagnetics General Corporation) |
| | • Dr. Gregory J. Yurek (American Superconductor Corporation) |
| 15:40 - 15:50 | Discussion |
| 15:50 - 16:05 | Break |
| 16:05 - 17:05 | ISTEC |
| | • Dr. Osami Tsukamoto (Yokohama National University) |
| | • Mr. Masayuki Aoki (Cryodevice Inc.) |
| 17:05 - 17:15 | Discussion |
| 19:00 - 21:00 | **Conference Dinner** |

302-762-0516

**October 14 (Thursday)** Session* → Nijou Room #2

| | |
|---|---|
| 09:30 - 11:30 | **Session 3: General Discussion of Joint Communique**<br>Chairpersons: Mr. Masaharu Higuchi (ISTEC)<br>Dr. Juan Farre (CONECTUS) |
| 09:30 - 10:30 | Summary of the ISIS-8 Joint Communique |
| 10:30 - 10:45 | Break |
| 10:45 - 11:30 | Open Discussion of Joint Communique and the Next ISIS Meeting |
| 11:30 | Adjournment of ISIS-8 |
| 12:30 - 17:30 | **Optional Technical Tour** (all times are tentative)<br>Research Institute of Innovative Technology for the Earth (RITE), Soraku-Gun, Kyoto Prefecture, Japan |
| 12:30 | Departure from Kyoto Kokusai Hotel |
| 14:00 | Arrival at RITE and short tour (about 1 hour) |
| 15:30 | Departure from RITE |
| 17:30 | Arrival at Kyoto Kokusai Hotel |

* Simultaneous English/Japanese translation available

# INTERNATIONAL SUPERCONDUCTIVITY INDUSTRY SUMMIT

**ISIS-8**
**October 12-14, 1999 - Kyoto, Japan**

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(Revised: 10/8/99)

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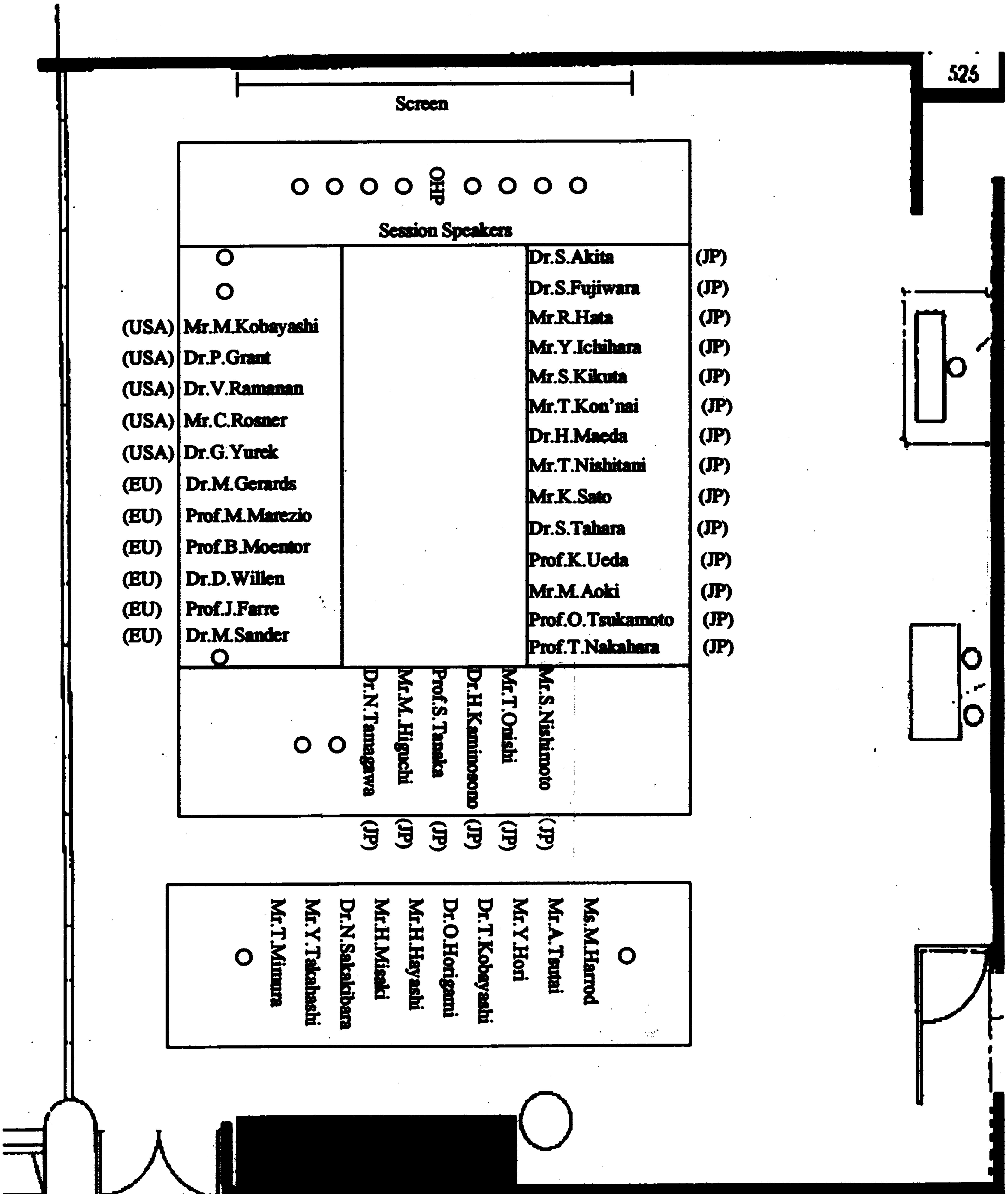
# ISIS-8 Meeting (Nijou #2 )



## Remarks by Gregory J. Yurek at ISIS-8

- I want to start by referring to a May 1999 issue of Forbes Magazine: an article in this issue was entitled: "Burn More Coal – The PC's Are Coming".
  - the article pointed to a projection by Intel that there will be over 1 billion PC's on the Internet
  - the authors calculated that the demand for electricity required to run such an Internet would be equal to the amount of electricity generated in the U.S. today!
  - The article also spoke to the issue of reliability: the "Internet Economy" demands much higher reliability of the electricity supply than other economies – it demands "computer-grade power"
- Mix that demand for more power that is more reliable with the significant power failures that occurred in major cities, along with the spikes in prices that occurred for power, during the last two summers,
  - and we start to understand the urgent need to find ways to increase the capacity of the electrical networks
  - in a Wall Street Journal article two weeks ago, the head of transmission and distribution at Commonwealth Edison in Chicago was quoted as saying: "We have plenty of generating capacity – our problems are related to the capacity of the supply system"
- The increase in capacity will be achieved by relieving constraints in the electric power grid
  - constraints that are caused by both physical bottlenecks – problems with copper-based power cables – and also by regulatory bottlenecks – issues of government policy
- While relieving bottlenecks in the electrical grid is necessary to meet the growing demand for electric power by the Internet Economy,
  - it is not sufficient to meet the Internet's every increasing needs for more reliable power

- There are many so-called "convergences" in technology and business that have taken place over time
  - and that have created magnificent changes in our world
- One important set of convergences is the availability of advanced ceramic materials, such as optical fibers, made from a ceramic called glass, and the deregulation of the telecommunications industry in the United States
- Another convergence is occurring today: ceramic-based superconductor wire and deregulation of the electric power industry, which is occurring on a world-wide basis
- Let's step back and look briefly at the history of optical fiber technology, which was driven in the earliest days primarily by Corning

Here Dr. Yurek will refer to the slides for the remainder of the presentation...

Small-Scale SC Applications:
The American Perspective

Paul M. Grant
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Abstract: We will review the technical status and commercial outlook for small-scale superconducting electronics for the areas of communications, sensors and digital applications in the US. Although progress continues in all three, especially in sensors, commercialization prospects are uneven. Several hundred HTS-based cellular ground stations were sold in 1998-99, and
at least two startup companies have emerged marketing HTS and LTS scanning
SQUID microscopes. However, the US program in digital electronics remains subcritical and undersupported by the government. We suggest the latter will require renewed efforts by US government funding agencies, both scientific and military, if the United States is to retain a viable program.

The 8th International Superconductivity Industry Summit
October 12-14, 1999 (Kyoto)

# Present Status of SC Industry in Japan for Large Scale & Power System Application

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**Abstract:**

Large scale and power system application in the field of superconductivity is reviewed, focusing especially on the progress after ISIS-7.

First, the present status and issues of HTS wire development is summarized. BSCCO wire performance has steadily improved. From the technical point of view, one of the most significant improvements is in the wire mechanical strength which uses a silver-alloy sheathing technique. This technique shall be essential for building devices as well as for operation for many application purposes. Steady performance improvement in long length wire will allow a drastic decrease in cost/performance value, and broaden application areas soon. Substantial effort has been exerted to develop a next generation wire using YBCO and related compounds. Three major techniques, i.e. textured substrate type, aligned buffer layer type and rapid growth superconducting layer type, have been pursued in parallel.

Further to the progress of large scale and power system applications, HTS cable, Generator, FCL, HTS transformer, HTS flywheel, SMES and MAGLEV are reviewed.

Tokyo Electric Power Company and Sumitomo Electric have been jointly developing HTS cable targeting a large capacity of ~1,000 MVA, long length, reliability and cost reduction. The present status is to develop a 3-core cable system to verify long-term tests of electric insulation, thermal insulation and cooling system, etc.

Two kinds of demonstrators were connected with a commercial grid of two utility companies. One is a 1kWh/1MW SMES connected with the grid of Kyushu Electric Power Company Inc., and the other is a 70 MW generator connected with the 77kV grid of the Kansai Electric Power Company Inc.

The MAGLEV train achieved a maximum speed of 552 km/hr in a five-car train set, verifying the enhanced reliability and durability of the superconducting magnets.

## Typical Projects of HTS Material, Wire & Application in Japan

| FY | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|
| Material & Wire | Super GM (HTS Wire) | | | | | | | |
| | ISTEC | ISTEC 2nd Phase (HTS Bulk, Next Generation Wire) | | | | | | |
| [illegible] | [illegible] | | | | | | | |

## HTS Superconducting Cable

**Subjects for commercial use**

**Large capacity**
(~1000MVA)

**Long length**
(~500m : span length)

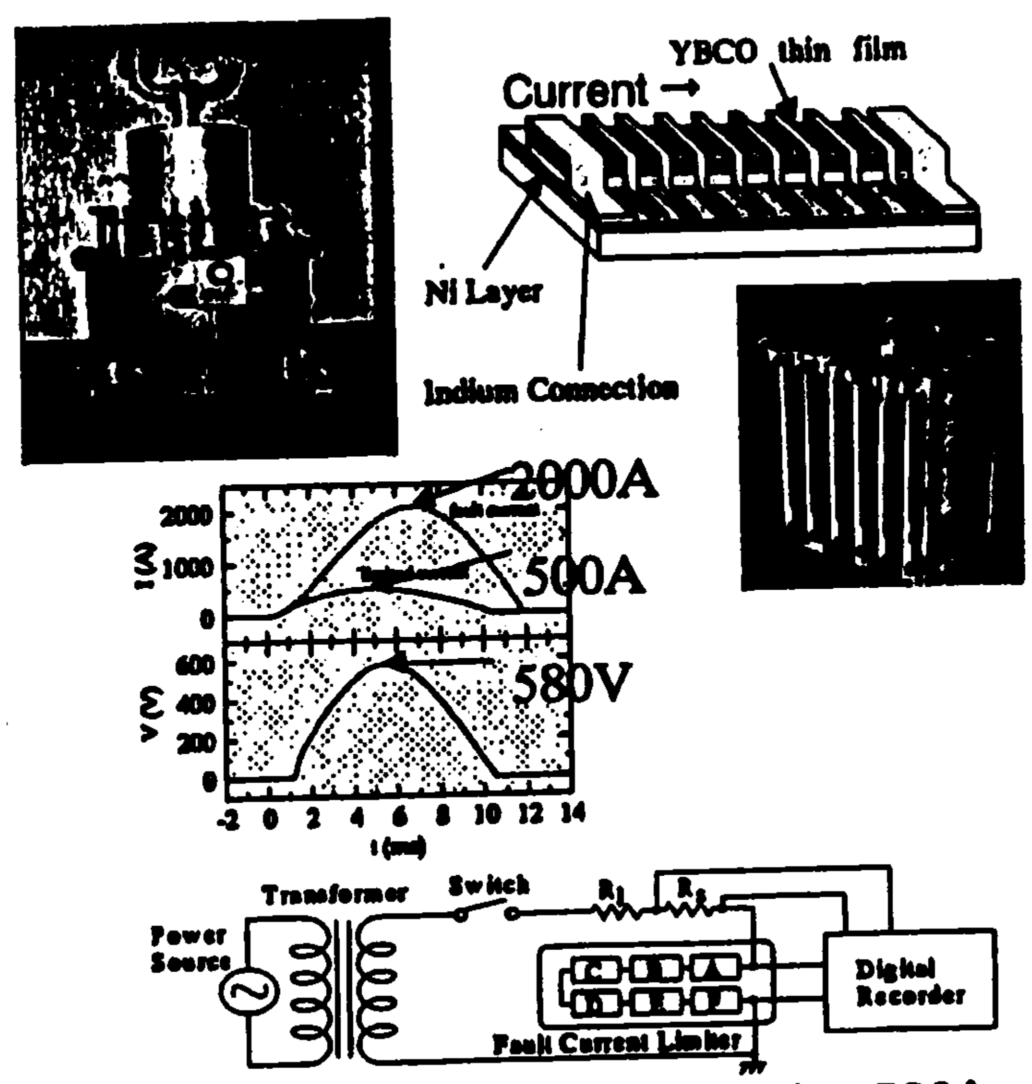
**Reliability**

100m 3-core cable system
(1999~2002)

**Cost reduction**

## Fault Current Limiter (FCL)

(1) NbTi 6.6MVA (2) YBCO 2.6kVA




Fault current of 2000A was suppressed to 500A

**Present Status**

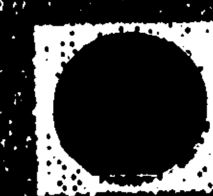
(1) LTS FCL

*TEPCO-TOSHIBA*

Capacity 6.6kV-1kA 6.6MVA

Fault Current 56kA→5kA

High Cost



(2) HTS FCL

*MELCO*

Capacity 0.8kVA Mlands

*TOSHIBA*

Capacity 2.6kVA Parallel Metal

**Subjects of FCL**

Reaction within a half cycle

Sufficient capacity over MVA

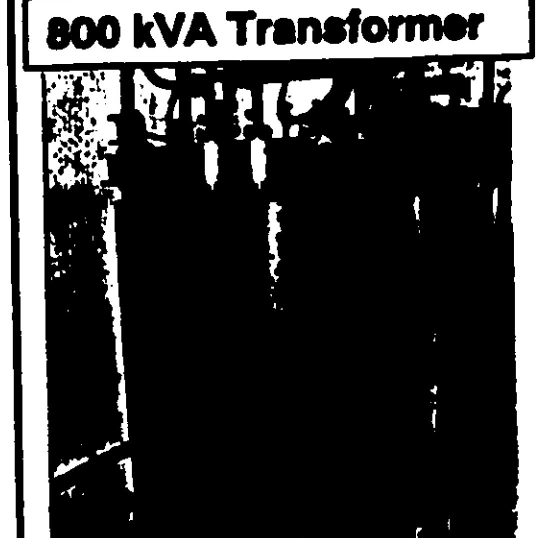
Cost reduction

¥4/VA for Main line

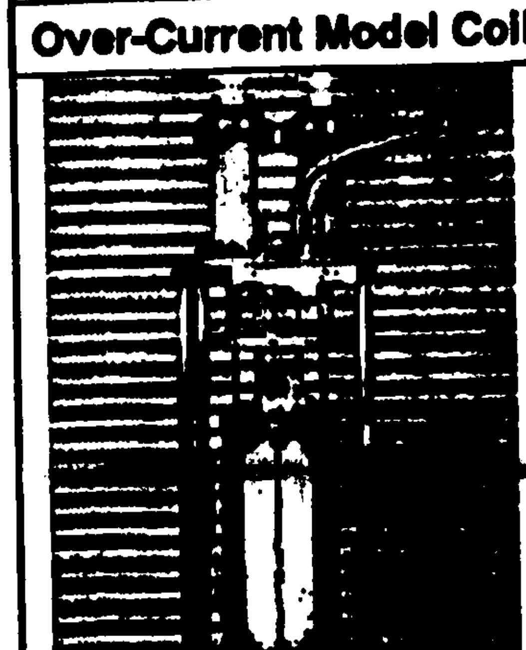
¥1.5/VA for Distr. line

## HTS Transformers

800 kVA Transformer



Over-Current Model Coil



- **800 kVA Transformer (1996)**
- **Over-current Model Coil (1999)**
  - **10 times excess current**
- **High-voltage-type Transformer (2000)**
  **(22 kV / 6.9 kV, 1 MVA at 66K)**
  - **AC withstand voltage: 50 kV**
  - **Lightning impulse voltage: 100 kV**
  - **Field test in a power grid of Kyushu Electric Power Co.**
- **Issues for Actual Implementation**
  - **Large capacity: >10 MVA**
  - **Cost down**
- **Merits**
  - **Light Weight: 60% down**
  - **Environmental friendly without $SF_6$**

田中部長講演 OHPコピー

# Research and Developments of Superconducting Electronics in Japan

International Superconductivity Industry Summit '99

October 13, 1999

Shoji TANAKA

Superconductivity Research Laboratory

ISTEC

(1) "Fundamental Research on the Behaviors of Circuits of Single Flux Quantum Devices" (LTC)

by Science and Technology Agency

1997 - 2001

(2) "Research and Developments of HTS SFQ Devices and their Circuits"

by MITI

1998 - 2002

<u>INTERMAGNETICS GENERAL CORPORATION</u>

# A STUDY OF BUSINESS SUCCESS PARAMETERS

## - LESSONS LEARNED –

Carl H. Rosner
Chairman - Board of Directors

## ABSTRACT

For most of the 20th Century, the phenomenon of superconductivity has stimulated enormous scientific interest and research activity that has increasingly led to some important fundamental understanding of physics which resulted in the awarding of several Nobel prizes.

During the many decades since the discovery of this phenomenon, the quest for applying that basic scientific knowledge towards the practical use of superconductors to a range of technical and commercially attractive devices has increased dramatically. Success in such endeavors would confirm the inherent promise of large-scale energy savings as well as providing very desirable environmentally safe benefits. A worldwide effort to demonstrate the usefulness of superconductor-based electrical and electronic devices has been tantalizing and continues to look promising, but it has as yet yielded only limited success.

Since its spin-off from General Electric in 1971, Intermagnetics has been one of very few industrial organizations in the world that has achieved a significant and continued measure of commercial growth in applied superconductivity. The publicly owned USA Company is now reporting over 100 million dollars in annual sales, while generally achieving consistent profitability in its operations.

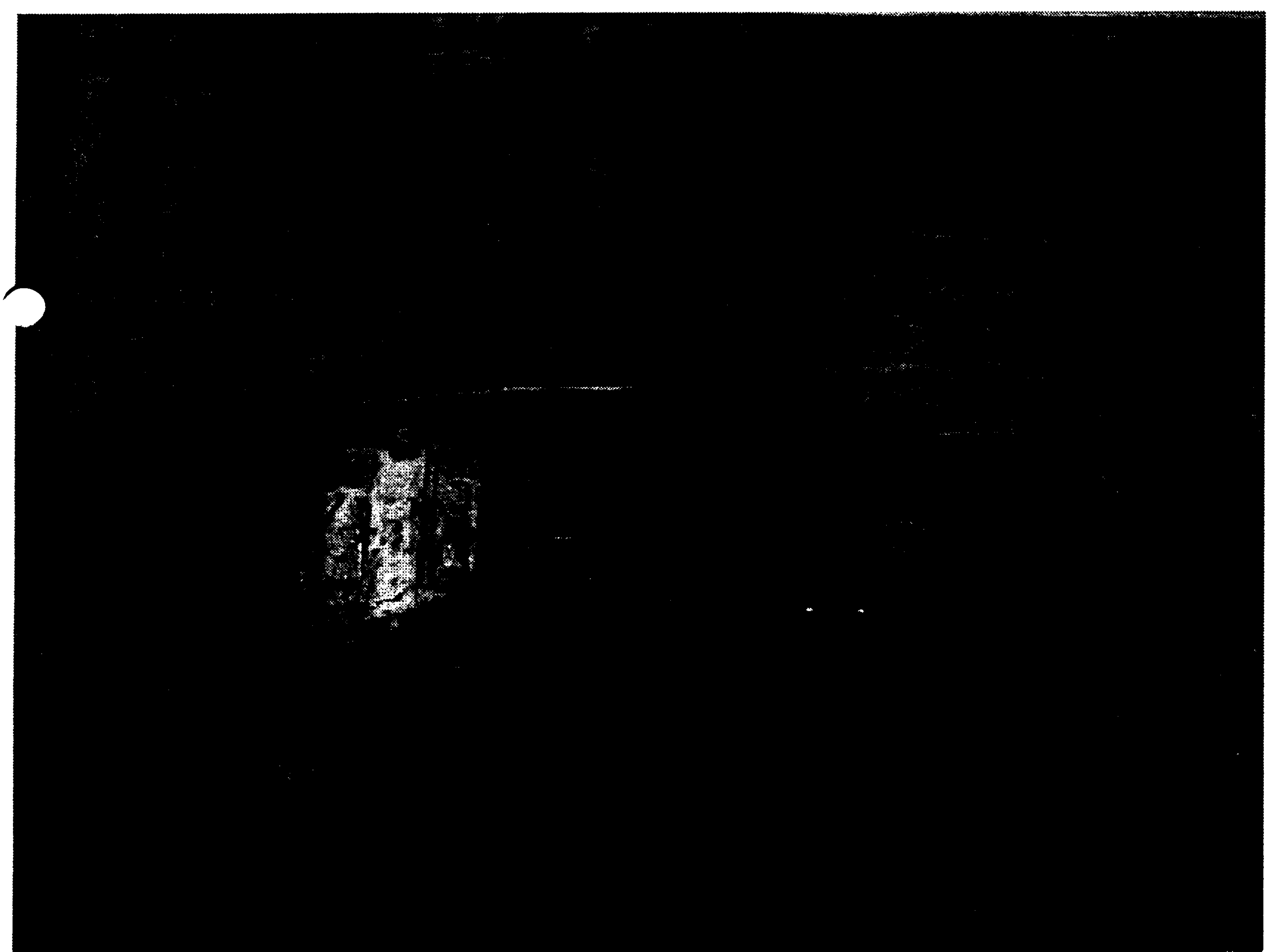
An attempt is being made here to provide an assessment as to which of the company's varied activities, characteristics and parameters can be identified that most likely were critical to the achievement of Intermagnetics unique and singularly successful position in its industry. Can the "lessons" learned from such an evaluation be replicated on an even much larger scale in the 21st Century??

# Possibility of Venture Business in Power Applications of Superconductivity

## *– Situations in Japan –*

O.Tsukamoto
Cooperative R&D Center
Yokohama National university

Various paths to VB from Universities,
Companies,
National Latoratories,
Independents, etc.



Title HTS Filter Systems for Mobile Telecommunication Base Station
( HTS : High Temperature Superconductors)

Author Masayuki Aoki

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500-1 Minamiyama, Komenoki-cho, Nisshin-shi, Aichi-ken, 470-0111 Japan

Abstract

With the start of the multimedia communication age, multifarious low-cost mobile telecommunication services of various providers have become available to users. This has increased the domestic prevalence of mobile telephones and portable phones remarkably, and the number of subscribers has already outperformed our expectations and is expected to exceed 50 million by the end of 1999. The realization of high performance mobile telecommunication systems is indispensable to cope with such a large growth in demand for use of the radio spectrum. To enable this, it-is considered effective to improve the quality of communications for transmitting high-volume information with less electric power, and to establish telecommunication systems that are tolerant to radio interference.

On the other hand, the development and application of High Temperature Superconductors (hereafter referred to as 'HTS') to various fields has been conducted by utilizing their characteristic of zero electric resistance below the temperature of liquid nitrogen (77K). In principle, a high unloaded quality factor (hereafter referred to as 'Qu') is achieved when HTS is applied to the microwave filter, therefore the insertion loss of the resonator which constitutes the filter decreases extremely. The application of HTS filters to mobile telecommunication systems has thereby been examined. As for the effects of HTS filters, it is expected that the noise figure will be reduced by utilizing the high Qu characteristic of the resonator that realizes the low-loss of the filter, and that the sharp skirting achieved by a large number of resonators which constitute the filter will also decrease the interference from adjacent channels.

In view of the above, given a six-year research project period, Advanced Mobile Telecommunication Technology Inc. (hereafter referred to as 'AMTEL') was incorporated in March 1994 through joint contributions from Japan Key Technology Center (hereafter referred to as 'KTC'), DENSO CORP., and ALPS ELECTRIC CO.,LTD. Focusing on HTS's excellent characteristics in the high-frequency range, AMTEL has conducted studies for utilizing HTS filters so as to develop a quantum key device which constitutes a high performance mobile telecommunication system, and continued research for realizing a mobile communication base station which utilizes the filter. These studies are for (1) HTS filters, (2) Low Temperature LNA, (3)Cryocooler, (4) Cryocable, (5) Cryopackaging, (6) Assembly of HTS Filter Subsystem, and (7) Evaluating effects for the mobile telecommunication system. Two types of HTS filter Subsystems (center frequency: 800MHz, 2.0GHz) were produced and their low noise figure and sharp skirt characteristic were confirmed at AMTEL. This verified that HTS filter Subsystems would efficiently achieve a high performance mobile telecommunication system. Further study of the HTS Filter subsystem will advance from the present limited application in quasi-microwave band, and be effectively utilized with any frequency bands in future.

Cryodevice Inc., a new company which inherited the above results from AMTEL, was established in April 1999 to deal with the technological development of the HTS Filter Subsystem that will be an element device of the next generation of mobile telecommunication systems. The capital of Cryodevice Inc. is 300 million-yen and the investors are DENSO CORP. (70%) and ALPS ELECTRIC CO.,LTD. (30%).AMTEL's R&D activity is going to end in March 2000, and its role will shift to patent management.