

*ANNUAL REPORT*  
**2016**

**ipt**  
INSTITUTO DE  
PESQUISAS  
TECNOLÓGICAS



## PRESENTATION



The year 2016 was a challenge for IPT and its community of employees, but also a time to reap the benefits from what we have sown since we implemented participatory and horizontal strategic planning in 2013, setting a goal that, by 2018, 40% of our revenues would come from innovation.

In the midst of a national crisis we have reached maturity in face of a program of reduction of working hours and wages while simultaneously setting a new record for revenues from innovation. The increase in revenues from 34% in 2015 to 38% in 2016 was made possible by the commitment of our 12 Groups and Technology Centers and our 800 employees, all attuned to the Institute's goal of establishing itself as the great innovation partner of both the national industry and the public sectors.

The São Paulo State Government increased its grant-in-aid to IPT by R\$ 13.5 million, thereby confirming its commitment to science and technology as a key sector driving growth, which was essential for us to continue these partnerships that will soon translate into benefits for the entire population. This is what we believe when we decide to embrace a project: that it will leave our laboratories and reach the market, thus contributing in the form of a new product or service to meet the needs of society.

IPT's participation, at times in a tiny but decisive stage and at others substantial, is not always visible. But it reaches our partners in multiple ways and reiterates a belief of our board of directors: innovation is not something that is done alone, but instead depends on a network, each member contributing its share of knowledge so that an idea, a good idea, actually gets implemented.

An outstanding example of partnership in 2016 is the project for the development of orthopedic prostheses of interest to the Association for Assistance to Handicapped Children (AACD), to be manufactured by 3D printing from niobium alloys with mechanical properties very similar to those of human bones. The project is being carried out within the scope of the Brazilian Company for Industrial Research and Innovation (EMBRAPII), an exemplary model of financing, and is sponsored by the Brazilian Mining and Metallurgy Company (CBMM). As we said, innovation cannot be done alone.

Another great achievement of the last year was the launch of the largest traction machine in Brazil, the Anchor Testing System. Conceived and designed by IPT, the system is used on equipment such as ships and offshore platforms, making a valuable contribution to the country's oil and gas sector, including deepwater drilling.

Contrary to common belief, the public area also innovates. And IPT has been present to support federal, state and municipal governments in this mission. In 2016, new steps were taken in the RSU-Energia project, whose aim is to propose solutions to reduce costs and incorporate new technologies in the area of urban solid waste, using Bertioga as a model city. These advances will soon be available to other local governments, contributing toward the construction of a technological platform, which is a requirement of the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo.

We point out these three examples, but more than 20 thousand technological services, tests, technical consulting services, research and innovation projects were carried out in 2016, leading us to continue believing in the sector's potential

to favor company competitiveness and improve people's quality of life, which, in the eyes of IPT, is the best representation of development.

Last year, also because we believe in the segment, we launched the journal IPT Technology and Innovation, which reflects the Institute's intense intellectual production in its 39 laboratories, and is aimed at contributing to the country's technological community. Another milestone achieved in 2016.

Beginning in 2017, auspicious news gives us renewed impetus to continue our work optimistically: once again, the Government of the State of São Paulo reiterates its understanding about the importance of science, technology and innovation by encouraging the São Paulo Research Foundation (FAPESP) to launch the Notice for the Support of Institutional Modernization. Thus, research institutions such as IPT will have R\$ 120 million to expand their capacity, based on projects aligned with the various state secretariats.

The highlights we have selected are an invitation to read our Annual Report, which describes these and other projects in greater detail. This report also contains information on the Institute's multiple activities, its general outcomes in 2016, and its financial statements.

**Fernando José Gomes Landgraf**  
Chief Executive Officer



## *IPT: your partner in innovation*

- 08. What is IPT?
- 10. Innovate with IPT
- 12. IPT in numbers
- 16. 2016: the year of innovation
- 18. Institutional highlights
- 20. IPT in the media
- 22. Planning for innovation

6

## *Featured projects*

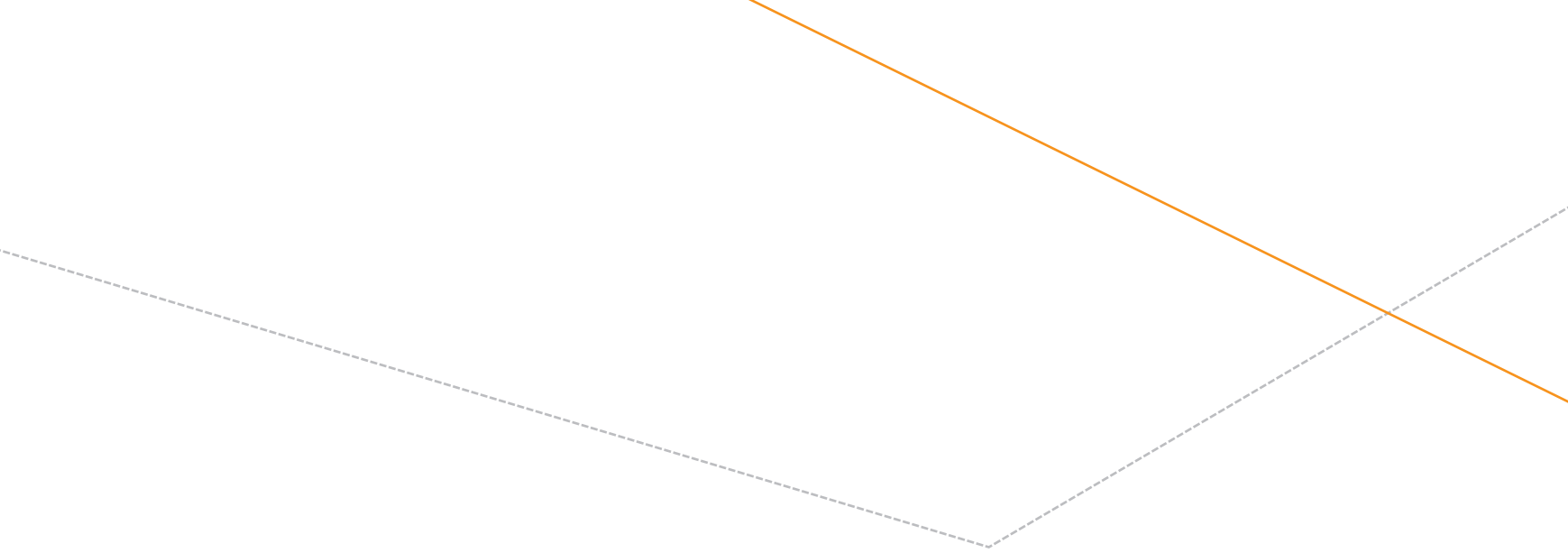
- 26. Diversified skills in multiple Technology Centers
- 28. Industry: an environment conducive to innovation
- 36. Sustainable solutions for cities
- 44. Metrology: from precision to performance, supporting excellence in the public and private sectors

24

## *Financial Statements*

- 52. Message to shareholders
- 53. Balance sheet
- 54. Income Statements for the Years Ending
- 55. Statement of changes in Net Equity for the Years Ending
- 56. Cash Flow Statements for the Years Ending
- 58. Opinion of the Fiscal Board about the Financial Statements
- 58. Independent Auditor's Report on the Accounting Statements

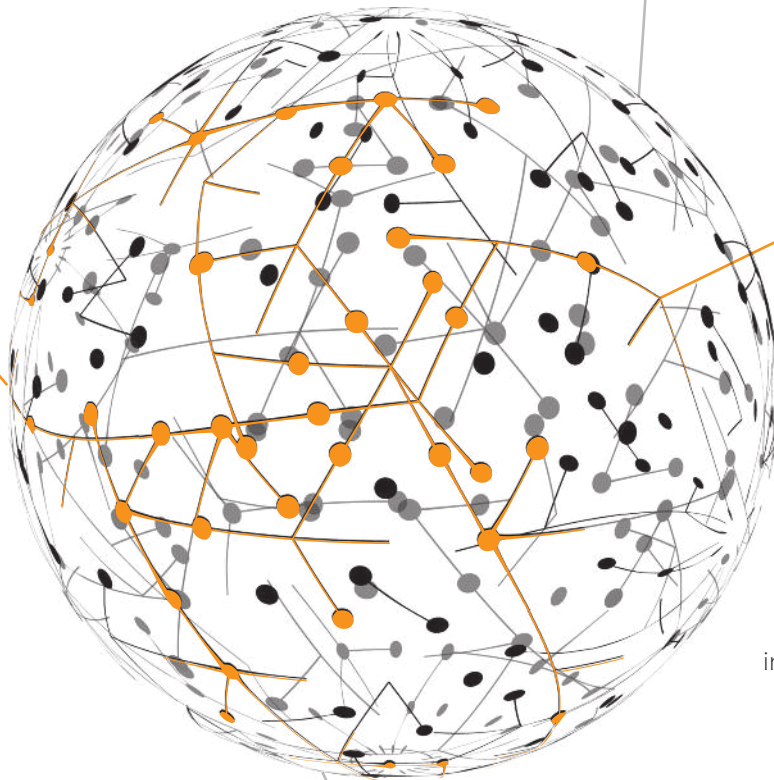
50





# ***IPT: your partner in innovation***

IPT's 100 year old tradition is to support the public and private sectors in their efforts to develop new technologies and innovate their products, processes and services. In this chapter, learn about the actions that ensure the excellence of this partnership and how they translated into the Institute's good performance in 2016.



## *What solutions do we offer?*

There are several solutions, with different levels of complexity and often tailored, to reach the final result desired by the client. Our metrological services comprise more than three thousand types of tests, calibrations, analyses, trials, measurements and the creation of reference materials. IPT's technical advice and technological services are underpinned by research, data collection and interpretation of results in support of the actions of contracting parties. At IPT, R&D focuses on the development of innovative projects for our clients. We also highlight our solutions for micro and small enterprises, involving export advice and the Mobile Units Project, which has mobile laboratories that provide on-site diagnostics at factories and propose solutions to technical problems involving raw materials, processes and products.

## *What is IPT?*

Laboratory infrastructure, qualified professionals and advanced equipment. This is the reality of the Institute for Technological Research – IPT, which for 118 years has focused on providing technical services and helping to create innovative processes and products. The result of our work means more competitiveness for the our clients and better quality of life for the population. Linked to the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo, but operating nationally, IPT was present at milestones in the country's growth, providing support, for example, in the implementation of the steel and aeronautical industries and the various sectors of national infrastructure.

## *In what sectors do we operate?*

It would be difficult to find a productive chain that has not been supported by IPT, which operates in the sectors of construction, infrastructure, forest resources, BioNanotechnology, chemistry, metallurgy, aeronautics, the maritime industry, and in many other areas that require technological support. This purview is the result of a history focusing on the multiple areas of knowledge that were and still are necessary for the country's development.

## *Who are our clients?*

Our portfolio contains more than four thousand clients, comprising small, medium and large companies operating in various industry segments, as well as in the service and public sectors.

## *How does IPT relate to its clients?*

IPT operates as a company divided into sectors, which ensure the agility and excellence of its projects, such as the Innovation Board and Quality Management Administration, as well as a communications and press office that works hand-in-hand with its clients to disseminate their projects.



## Why are we the best partner of those seeking to innovate?

We understand that innovation is not achieved alone. IPT plays a crucial role in the knowledge value chain, interacting with several players and possessing extensive experience in the presentation of proposals to development agencies, so that it operates as an integrator of public and private resources. Our staff, who interact with both universities and industry, are able to identify market opportunities while remaining apprised of the maturity stage of available technologies. In addition, our laboratory infrastructure allows for multiple tests, trials and developments, with exclusive equipment in the country and in Latin America.



A good example of IPT's role in this knowledge value chain is its relationship with the Brazilian Agency for Industrial Research and Innovation (EMBRAPPI), a federal government initiative to foster private investment in innovation through cooperation between companies and research institutions, with the Government of the State of São Paulo as financial counterparty. IPT offers its laboratory infrastructure, its researchers' expertise, support for negotiations and contracts, intellectual property management and process management, enabling researchers to focus on technical development. An example of such a partnership is the Artap project. For more information, see page 34.

## How do we qualify our staff?

The Institute operates a series of programs focused on updating and valuing its employees, staking odds on their ability to innovate. The Training Project is the best example of the Board's trust in the potential of IPT staff, enabling employees to explore new skills by proposing projects with promising research themes, for which resources and technical hours are allocated. IPT's Overseas Development and Training Program (PDCE) enables its staff to engage in interchange programs at renowned institutions around the world. Another way to value intellectual capital is through the Mentoring Program, which seeks to preserve knowledge at IPT by forming partnerships between experienced researchers and younger ones who, together, define a theme to be worked on throughout a year. The Program's 5th Cycle started in 2016, with a record number interested and 50 enrollees.

## How do we share knowledge?

IPT's doors are open to welcome new professionals and ideas, seeking a constant exchange that favors those who work with knowledge. Dialogues with universities take place through partnerships as well as the New Talents Program, through which IPT offers scholarships to postgraduate students from various institutions that carry out their research at the Institute's laboratories, using the latter's infrastructure and equipment, aided by an in-house co-advisor. Another way of maintaining this dialogue is through IPT's Professional Master's Degree courses in the fields of Housing, Industrial Processes and Computer Engineering, which draw heavily on teachers from the Institute itself.



**Training Projects:** In 2016, 10 projects were concluded and 26 were initiated. Funding, which totaled R\$ 2.4 million, was provided by the IPT Support Foundation (FIPT). One of the projects successfully completed was the launch of a specification manual for school uniforms. For further details, see page 51.

**PDCE:** Last year, eight researchers completed their training course in Spain, the United States, Norway, Italy, Germany, Portugal and the United Kingdom. See page 32 for details of the project that uses hygrothermal simulation for the selection of facade cladding considering regional climate conditions. A substantial part of this project was developed during an overseas training program.



**New Talents:** Last year 16 students joined the Program, which already had 42 participants, representing a total of R\$ 364 thousand in scholarships..

**IPT's journal Tecnologia e Inovação:** This form of interaction with the community gained another element in 2016. Launched in April, the journal summarizes the production of IPT's professionals in technical articles, aiming to share the knowledge accumulated and advances achieved with the external public and the technological community.

# Innovate with IPT

In 2016, IPT served approximately 3,100 clients in a variety of segments, producing more than 21,000 technical documents and managing R\$ 18.5 million in innovative projects within the scope of EMBRAPPII alone. Check out the guidelines below about how to become an IPT customer, participate in technology programs, and access resources available for innovation.

## Municipal Government

1

Access the Technological Support Program for Municipalities (PATEM) offered by the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo, which places the Institute's technical capacity at the service of small and medium sized municipalities.

2

Have a good part of resources financed by the aforementioned Department, requiring the municipal administration to make a complementary contribution varying from 0% to 50% of the total value of the service.

3

Count on solutions in areas such as landfills, recovery of permanent preservation areas (PPAs), waste management, mapping of risk areas, erosions, mining and several other segments.

## Company

1

To develop a R&D project, explain your requirements to IPT and receive its assistance in the development of the scope of your project.

2

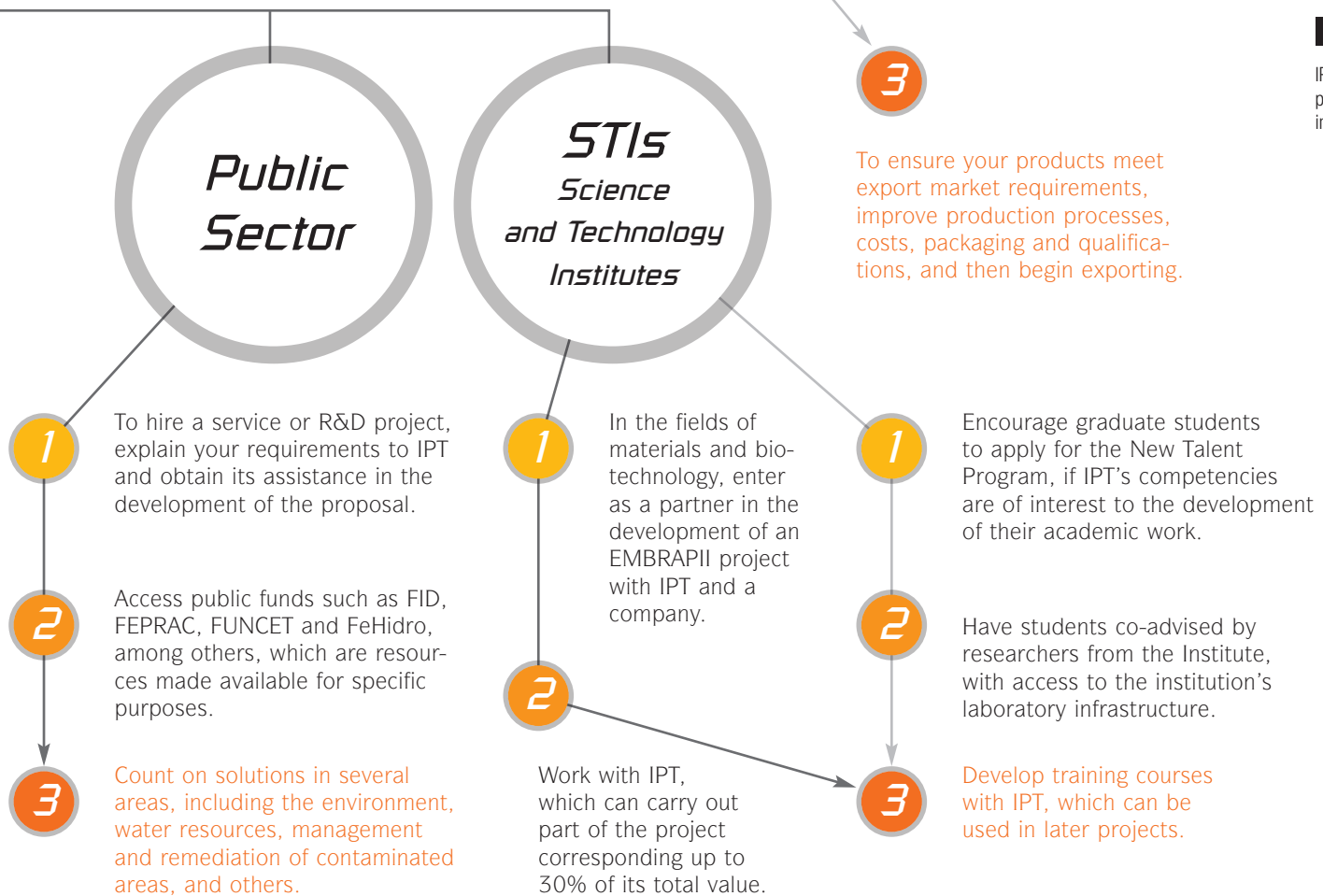
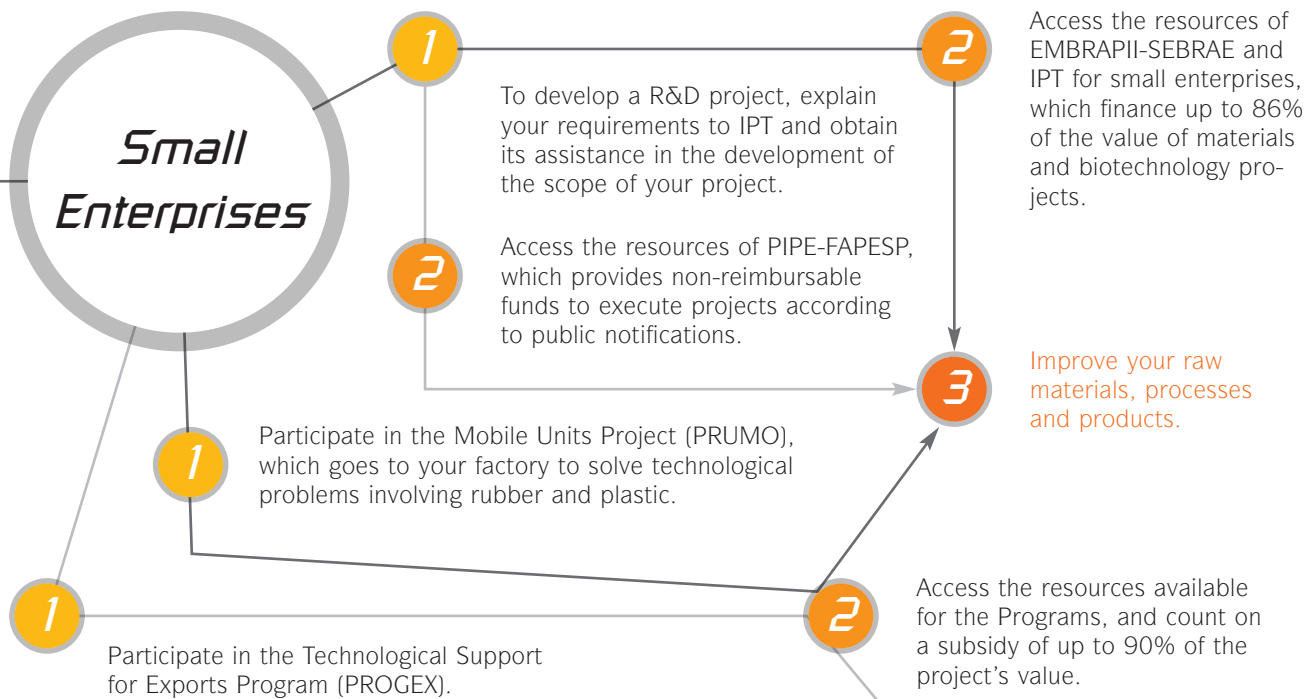
Access the resources of EMBRAPPII and IPT, which subsidize up to 53% of the value of projects for the development of materials and biotechnology.

2

Access the resources of FAPESP, BNDES or FINEP, which subsidize a predefined percentage of the value of projects, according to notices notifications.

3

Innovate by improving or creating new raw materials, processes and products.



# ***IPT in numbers***

IPT's performance in 2016 is described here based on its main figures and indicators, as well as charts that demonstrate the Institute's consistent performance in recent years. Despite the recognized impact of Brazil's economic crisis on IPT, various solutions enabled the institution to minimize its effects.

**3100**

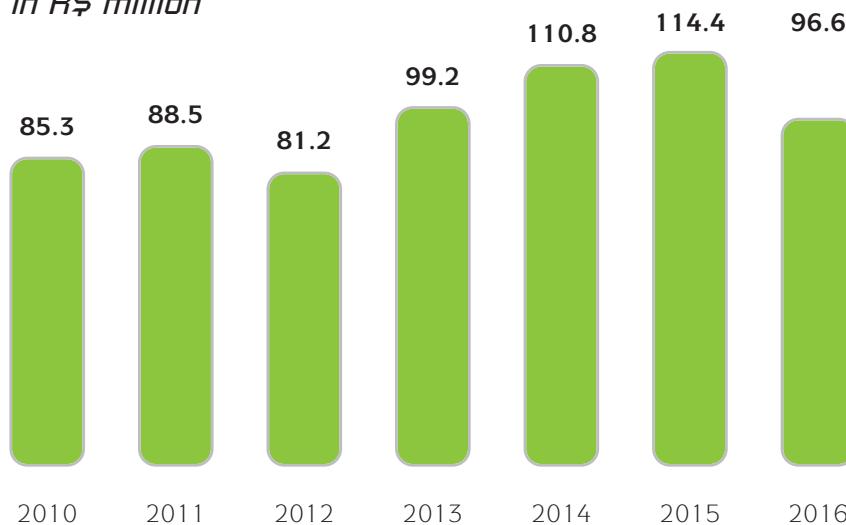
companies served

**21,000**

More than technical documents issued, including appraisals, reports and opinions

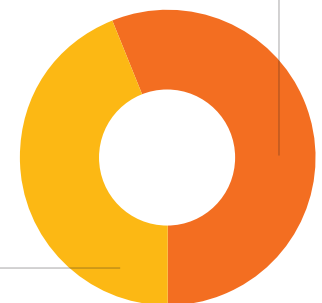
R\$ **96.6**  
million  
in revenue

## *Annual evolution of revenue in R\$ million*



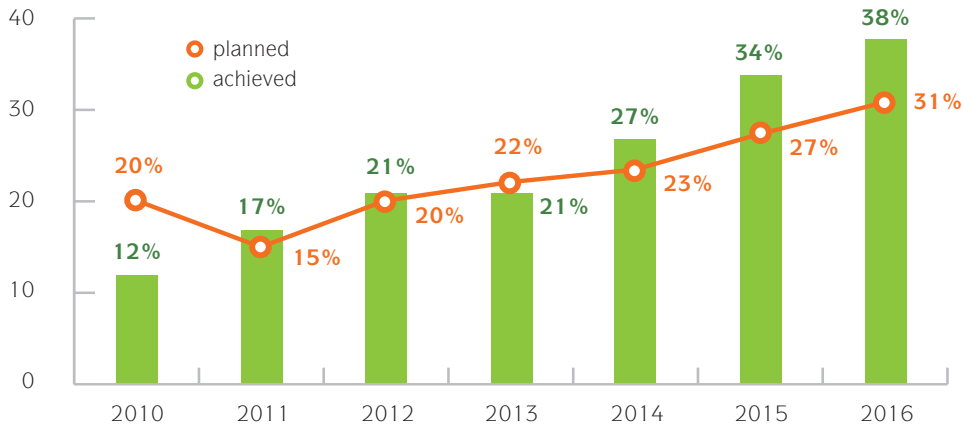
Although the national crisis contributed to the drop in IPT revenues, the economic result was considered positive in this situation. Factors such as a decrease in the cost of services and administrative expenses, the program of reduced working hours and salaries agreed upon with employees, and the increase of subsidies from the São Paulo State Government enabled the Institute to offset the 1.7% drop in its gross operating income.

**56%** of revenues generated by service contracts



**44%** as an endowment from the São Paulo State Government

## Revenue from innovations

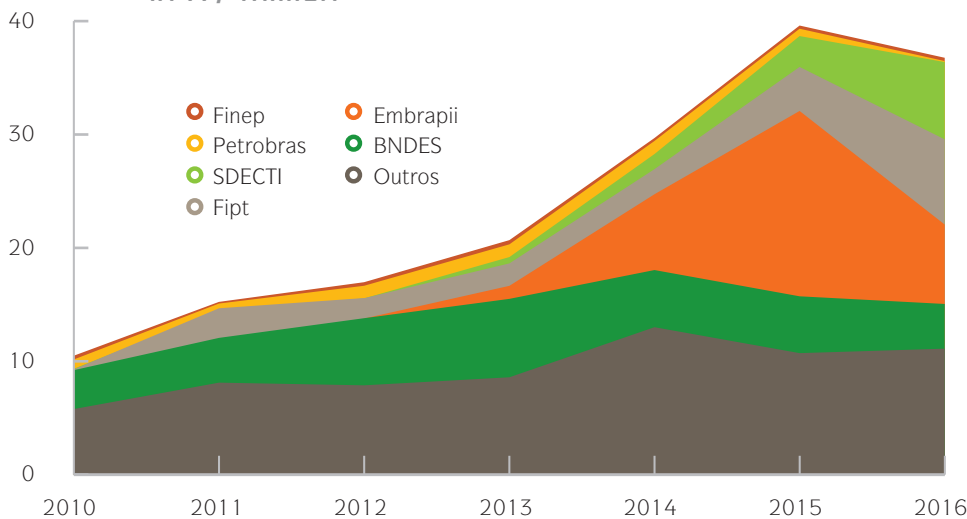


In 2016, IPT set a new record for sales of innovative projects, making giant strides towards its goal of reaching 2018 with 40% of its revenue stemming from innovation.

7 new innovative project contracts sponsored by the Brazilian Company for Industrial Research and Innovation (EMBRAPII), corresponding to

**R\$ 10 million**

## Revenue from innovations largest clients and partners in R\$ million



Among IPT's various innovation partners, EMBRAPII occupies a prominent place due to its less bureaucratic model, which favors speed in decision making. The Institute is an Embrapii Unit in two areas of increasingly technological requirements : High-Performance Materials and Biotechnology.

**8**

patent applications

13

IPT: your partner in innovation

**24**

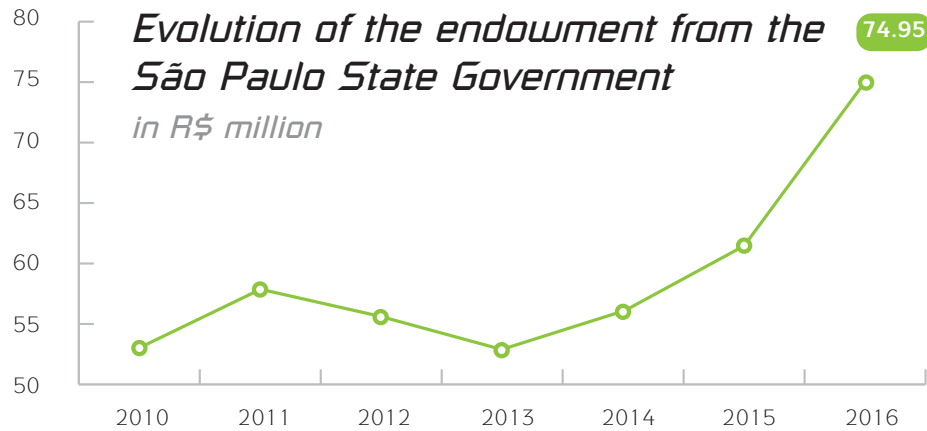
articles published in partnership with companies

**244**

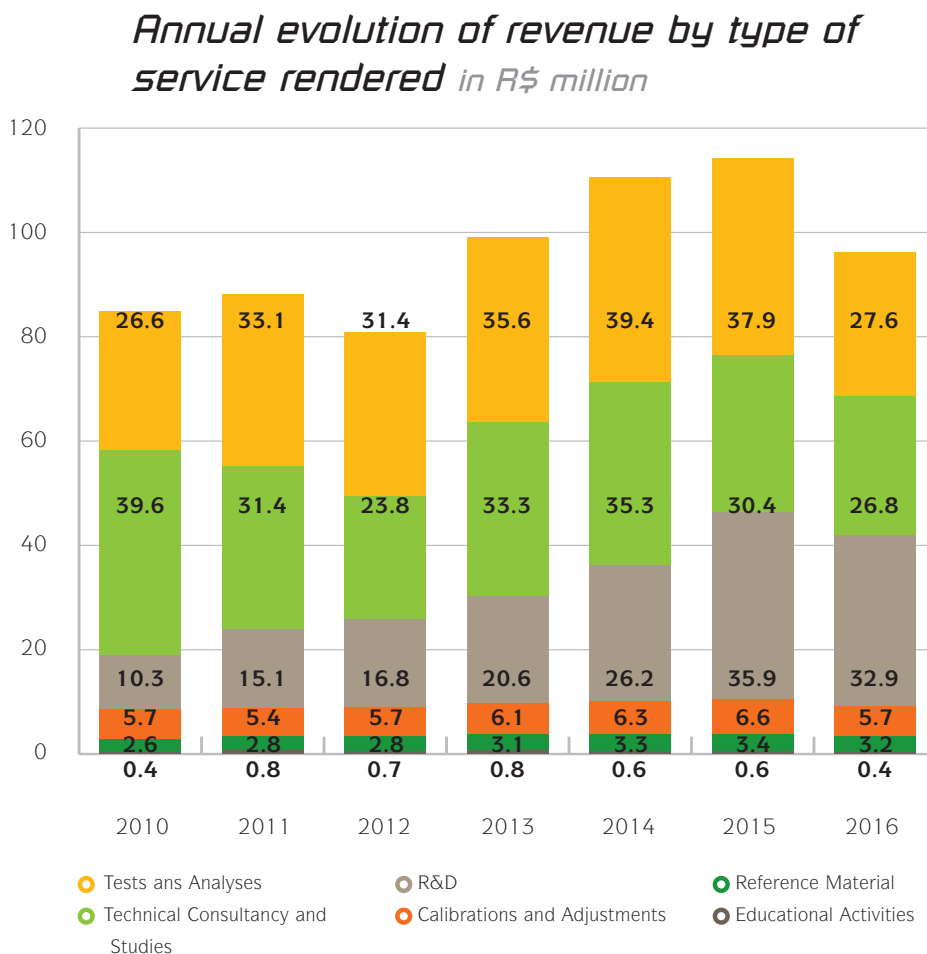
technical publications

**38%**

of revenue generated by innovation



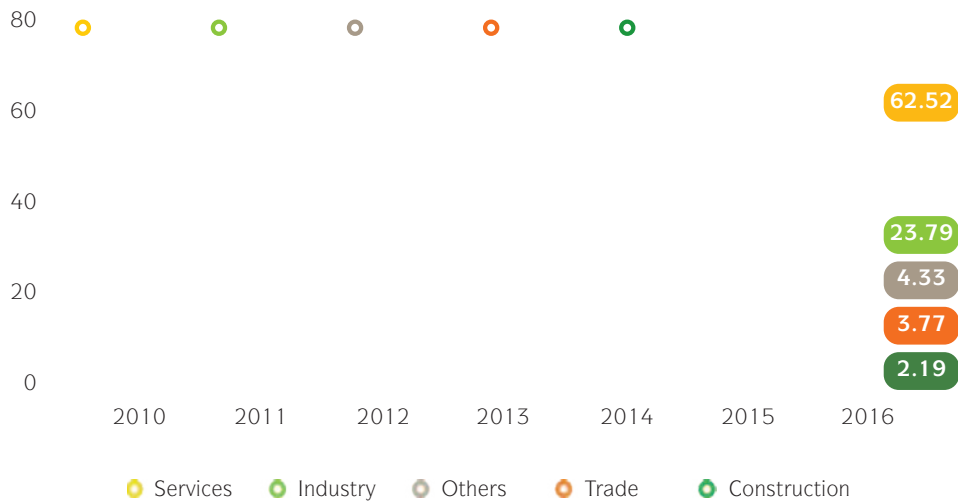
The Government of the State of São Paulo, which traditionally allocates funds to the science and technology sector, increased its economic financing to IPT by R\$ 13.5 million, indicating that investing in innovation is one of the possible solutions to the crisis.



**R\$ 2.4 million**  
invested in internal research and development training projects

The three graphs of the annual evolution of revenue demonstrate the diversity of performance of IPT, which serves both public and private clients in the service, industry, commerce and construction sectors. Among the services offered by the Institute, there is a noticeable balance between tests, technical consulting and research and development, with steady growth of the latter, which includes innovative projects.

*Annual evolution of revenue by sector of activity of clients in R\$ million*

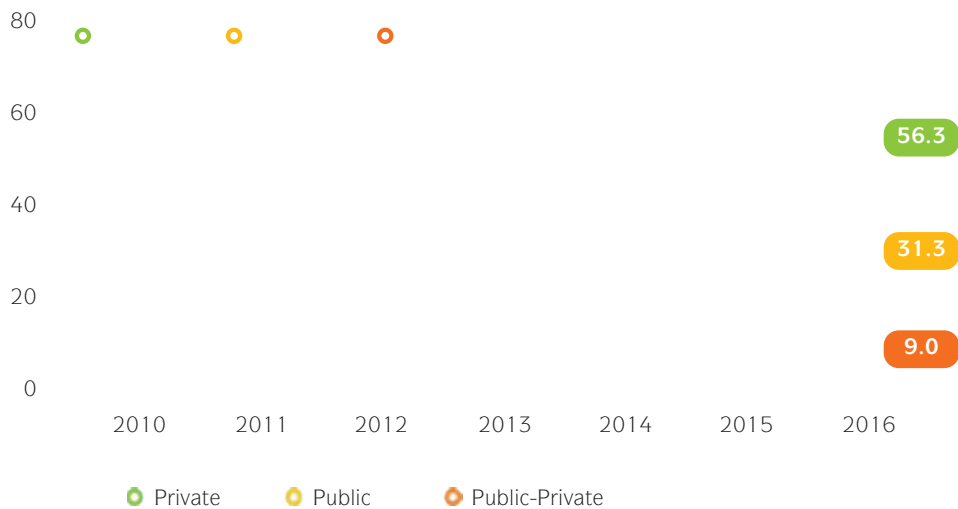


**R\$ 364 thousand**  
 in scholarships from the New Talents Program and enrollment of 4 PhD students, 12 masters students and 3 postdoctoral researchers

15

IPT: your partner in innovation

*Annual evolution of revenue by type of clients in R\$ million*



**784** employees,  
 95 with PhD and  
 131 with Masters degrees

**355** professionals trained in short courses, specialization courses, improvement and professional masters courses offered by IPT

## *2016: the year of innovation*

There are many reasons why IPT is an important partner when it comes to innovating, including its technical competence, laboratory infrastructure, capacity to link funding sources to industry, and a privileged position in the chain of knowledge production. In 2016, this condition as a relevant partner in innovation was a highlight of the Institute. The second edition of the Valor Inovação Brasil 2016 annual ranking, prepared by the Valor Econômico Group, announced the 100 most innovative national companies in 17 sectors and indirectly recognized IPT as a great partner: among the 10 companies at the top of the list, nine were IPT clients in the last 10 years. Among these 100 companies, more than 70% sought out the Institute when it came time to innovate. Check out testimonials from partner companies explaining why working with IPT was good business.



**Embraer** A reference on innovation in Brazil, Embraer has been in partnership with IPT for many years. In 2014, the inauguration of the Institute's Lightweight Structures Laboratory (LEL), installed in the Technology Park of São José dos Campos (SP) to meet the demands of research and development of materials such as aluminum, titanium and carbon fiber, further strengthened IPT's relationship with this leader in aeronautical engineering. Details of the strategic project between this company and IPT are available on page 36.

**“The LEL/IPT contributes to Embraer’s innovation process because it is able to understand the needs of industry and the generation of knowledge through highly trained people and cutting-edge research infrastructure, which is exemplified by the technological cooperation Design of rear fuselage of composites, which demonstrated the application of composite materials technology on a real-scale section of fuselage.”**

**Daniel Moczydlower**

Director of Technological Development of Embraer



**Natura** IPT and Natura have a long-standing partnership in different areas of research and development. Two quite recent cases exemplify this joint work: the cooperative project in nanotechnology, which involved Natura and three other cosmetics companies in an unprecedented technology sharing model, and a collaboration to produce a tensioactive substance aimed at transforming a residue that was being discarded into a raw material for cosmetics. This interaction has already resulted in the Institute receiving the Technology Partner Award 2016, which is part of the recognition of the company's best innovation partners, based on criteria such as quality, innovation, service and relationships. On the occasion of the award ceremony, Natura's Vice President of Innovation, Gerson Valença Pinto, highlighted the importance of IPT's support in the development of Natura. The partnership is proving to be so positive that IPT and Natura have produced a video to demonstrate the importance of the collaboration between companies and research institutions for the development of innovation in the country. Find out more at [http://www.ipt.br/noticia/1181-parceria\\_de\\_sucesso.htm](http://www.ipt.br/noticia/1181-parceria_de_sucesso.htm)

“

**“Nothing can be done alone. We do not have all the skills, resources or knowledge, so we complement them through partnerships. We believe in the complementarity of competencies.”**

**Gerson Valença Pinto**  
Vice President of  
Innovation of Natura

17

IPT: your  
partner in  
innovation



## *Institutional highlights*

In addition to IPT's numerous projects, the daily routine of a research institution consists of a series of other activities, which, from the standpoint of its internal organization and institutional relationships, are considered important achievements. Check out the highlights of 2016.

- **Recipient of the Octavio Frias de Oliveira Award in the category of Technological Innovation for the design developed in partnership with the Butantan Institute**, which involves studying the possibility of using the protein Amblyomin-X to treat tumor cells. The award encourages the production of national knowledge aimed at preventing and fighting cancer. The participation of the Institute's Group for BioNanoManufacturing (BIONANO) consists of the production scale-up of the molecule for testing on animals and other biological assays.

- **Recognition of the project Patria Processing and Application of Rare Earth Magnets for the High-Tech Industry**, proposed by IPT in partnership with the University of São Paulo (USP), among the 101 projects recommended as recipients of resources from the Ministry of Science, Technology, Innovation and Communications. The purpose of this announcement is to support research activities with a high potential for scientific impacts in strategic areas and which seek solutions to complex national problems.



- **Launch of the journal IPT Tecnologia e Inovação.**

Three issues of the journal were published in 2016, containing technical articles in which the IPT staff presented their intellectual output, which includes reflections and results on topics as diverse as industrial combustion, sustainability at construction sites, and nanolubricants.

- **Completion of the Brazilian Environmental Market Seminar,**

with a presentation of the publication "Panorama de Gerenciamento de Áreas Contaminadas" [Outlook for Contaminated Areas Management], which describes the structuring of the sector production chain in Brazil, a market with an annual turnover of around R\$ 1.5 billion in the country.



- **Beginning of activities as an Embrapii Unit for the Development and Scale-up of Biotechnological Processes**, whose goal is to invest R\$ 30 million by 2021, especially in the field of biochemistry of renewables.

- **Expansion of the sales effort: the value of proposals and estimates was 25% higher than in 2015.** One of the positive highlights was the historic record in innovation proposals, which exceeded R\$ 122 million in 2016, i.e., 66% higher than the previous year, indicating IPT staff's efforts to achieve financial results within a scenario of economic crisis. These numbers are accompanied by IPT's Annual Planning, which monitors institutional indicators and assists management decision-making on four themes of institutional action: innovation path, knowledge dissemination and training, sales relationships and efforts, and financial results.

- **Launch of a video concerning the Olympics of Knowledge about Natural Disasters**, organized by the Regional Civil Defense Coordinating Body of Baixada Santista, by the Municipal Civil Defense teams of nine cities and by IPT, completing an initiative for the education of 10- and 11-year-old students in municipal education systems. The focus of the program was the care to be taken during floods, landslides and lightning on rainy days.

- Participation of researcher Cláudia Echevengá Teixeira, from IPT's Residues and Contaminated Areas Laboratory (LRAC), together with the vice governor of the State of São Paulo and secretary of Economic Development, Science, Technology and Innovation, Márcio França, at the **8th Regional Leaders Summit**, in Munich, Germany.

- **Participation in a symposium on infectious waste** held at IPT, in which researchers discussed ABNT standards pertaining to terminology, classification, management, collection, storage and treatment of healthcare waste.

- **Establishment of a new area, Corporate Systems Management**, to develop solutions, and to organize and integrate the data generated by the Institute's various systems, aiming at improvements in IPT's strategic management. This new area manages Enterprise Resource Planning (ERP), which is responsible for storing all of the Institute's information on personnel, finance, accounting and projects, is integrated with the systems of municipal and state entities with which IPT interacts.



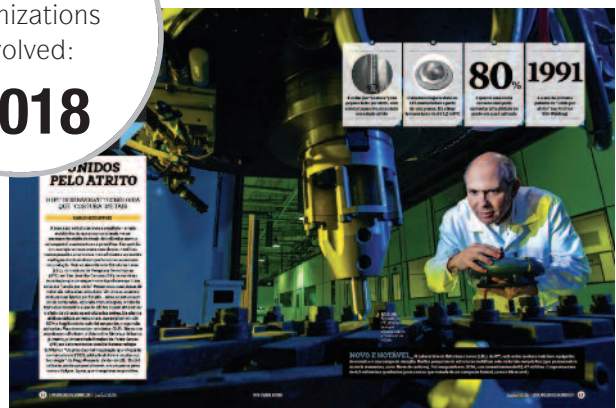
# IPT in the media

IPT's commitment to broad-based press relations has a specific purpose: the popularization of themes pertaining to science and technology and the dissemination of information about the importance of investments in innovation. In 2016, the Institute took advantage of one of the biggest events in Brazil to demonstrate the relationship between science and sport, developing ample material for journalists about metrology and Olympic Games. IPT's presence was also conspicuous in several topics on which IPT researchers expounded with great technical expertise. Check out the highlights of the year.



One of the major science and technology achievements of the year in Brazil was the production, by IPT, of the first 100 grams of **metallic didymium**, an essential Nb-Pr alloy for the manufacture of magnets used in the production of wind turbines, hybrid and electric cars and electronic devices. The theme was addressed by media organizations such as Valor Econômico, O Globo newspaper and FAPESP magazine.

Number of media organizations involved:  
**1,018**



Época Negócios magazine highlighted the advantages of friction welding technology, one of the competencies of IPT's **Lightweight Structures Laboratory (LEL)**. The next generation jets that will reach the market in 2025 will make extensive use of this technology, which can also be applied in the automotive and oil industries.

Exposure time on TV:

**5h48min23s,**

49 televised appearances



Planning **urban forestry** and acting preventively are solutions to deal with the fall of trees that occurs in urban centers during storms. IPT researchers discussed this subject with news reporters at TV Globo, Band and Record News, among other TV channels and newspapers.

Newscasts on Globo News TV explained the importance of **monitoring areas of risk** mapped by IPT in the city of São Paulo, a recurring theme in national newscasts, which is usually based on sources at the Institute.





**2,558**  
Number of news items:

News broadcasts on TV Cultura addressed the **innovative project of orthopedic prostheses** by additive manufacturing which IPT is developing with multiple partners, including the Association for Assistance for Disabled Children (AACD) and the São Paulo State Government.



On World Water Day, IPT launched a **manual of guidelines for graywater reuse**, the relatively clean waste water from baths and washing machines, with advice about the practice of sustainable actions. The manual was the subject of a report on SPTV, from Rede Globo, and of the Repórter Eco program on TV Cultura.



Geographic range:  
**24 estados**  
in all Brazilian regions

**Burocracia trava as pesquisas com empresas no Brasil**

PARA PRESIDENTE DO INSTITUTO DE PESQUISAS TECNOLÓGICAS, FM SP, FALTA AGILIDADE PARA FINANCIAR PARCERIAS PÚBLICO-PRIVADAS

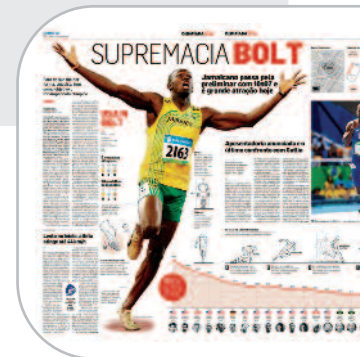
In an interview with Folha de São Paulo, IPT's CEO **Fernando Landgraf discussed the importance of basic and applied research for the country**, the speed and flexibility of Embrapii in the approval of projects, and the practice of entrepreneurship by researchers in the North American and Brazilian contexts.

**500**  
news items involving innovation

**Olympics and metrology**

When people watch the Olympic Games and get excited about the medals that are won, often by a fraction of a second, by a distance of millimeters or by a difference of one point, they don't realize that there is a science behind the magic of sports: metrology. IPT produced a report exclusively for journalists which explains how the science of measurement allows for fairer competitions, and how it can help make them more technological and efficient. Among the topics covered are weights and measures in games, speed in the Olympics, and aerodynamics in sports. Read all about the project at [http://www.ipt.br/olimpiada\\_e\\_metrologia/](http://www.ipt.br/olimpiada_e_metrologia/)

IPT: your partner in innovation



## Planning for innovation

IPT adopted Strategic Planning three years ago, with the participation of its employees who, banking on the multidisciplinary nature of their competencies, meet yearly in working groups to devise innovative solutions to the Institute's requirements. In this third and penultimate cycle that took place in 2016, nine teams focused on consolidating the prototypes that were designed, aiming at the definitive implementation of the new methodologies in their respective areas. We describe each of them below, relating them to the aspects of IPT's innovative culture.

1  
*Value diversity*

4  
*Have a team spirit*

3  
*Create connections*

2  
*Implement new ideas*

5  
*Learn from mistakes*

### Network of Correspondents

As a result of the work of the Communications group, the Network of Correspondents comprises volunteer representatives from the 12 IPT centers, which are responsible for keeping the Press Department apprised about the activities and projects developed by the areas, promoting internal and external communication at the Institute. The group also created an online system that will enable all IPT employees to register and view a variety of press-related data.



### Joint Solutions for MSEs

The Micro and Small Enterprise Technology Leverage group counts on IPT's proactivity in partnership with class entities to present global solutions that render each sector more competitive. Above all, the idea is to increase the innovativeness and competitiveness of their products. The team is engaged in a pilot project involving red clay ceramics in Bragança Paulista, with 19 construction companies clustered together in a Local Productive Arrangement.



### Partnerships with STIs

IPT also seeks the complementarity of its competencies in other science and technology institutions, which is why the Partnerships with STIs group has developed institutional guidelines for the establishment of partnerships and is now working on a systematic roadmap to help the technical units interact more closely with other institutions. The team is also running a pilot project in formal partnership with the Polytechnic School of the University of São Paulo.



### Government Observatory

The Government Observatory, a prototype delivered by the group IPT's Role in Government, comprises representatives from the Institute's 12 centers, as well as members of the board of directors and of other bodies of the institution, whose task is to search for, organize and select information on projects and services performed or with a potential to be rendered to governments, discussing the structured information and selecting topics for the preparation of white papers and the proposal of integrated solutions.





## Technology prospecting process



Seeking the mastery of new competencies, the product being delivered by the New Technology Competencies group is the creation of a general technology prospecting model. As validation prototypes, the team developed the theme Additive Manufacturing, which is currently being implemented at IPT, and is now working on the prospection of the theme Distributed Generation.

## Network of Integrators



Composed of researchers from several areas of IPT, the Network of Integrators is part of the prototype developed by the Integrating Solutions group, which seeks to effectively meet so-called complex requirements, i.e., those that require multiple competencies of the Institute. The team, which has created an institutional channel with the Board of Innovation, is responsible for activating the Network, which will map the areas that can meet the client's needs.

## Inclusion in the innovation ecosystem



Through the group created in the preceding Strategic Planning cycle, IPT seeks to engage with scaleups, i.e., companies whose growth is rapid and sustained over a long period of time, in order to understand how to provide technological assistance to this type of company, aiming to increase innovation and solve technology bottlenecks. The objective is to envisage suitable language, timing, positioning and negotiation methods for this market.

## Chambers of Technology Innovation



To strengthen relations with government companies, the Government Relations group has created Chambers of Technology Innovation (CTI), which bring together public companies that offer services to society, in order to discuss technology requirements and innovation opportunities. The first Chamber, which pertains to the transport sector, identified requirements for three working groups tasked with developing projects for solutions for water management, operations and energy monitoring and energy efficiency.

## Presence of an innovation culture



The Innovation Culture group developed a method to evaluate the presence of innovation concepts, listed in this infographic, in the centers, laboratories and support areas of IPT. The methodology is based on the analysis of data garnered during individual interviews with employees, and its operation will be the responsibility of the People Management Coordination Office. The method calls for the creation of action plans specific to each area, in such cases where some aspect is absent or very low, aiming to improve it.

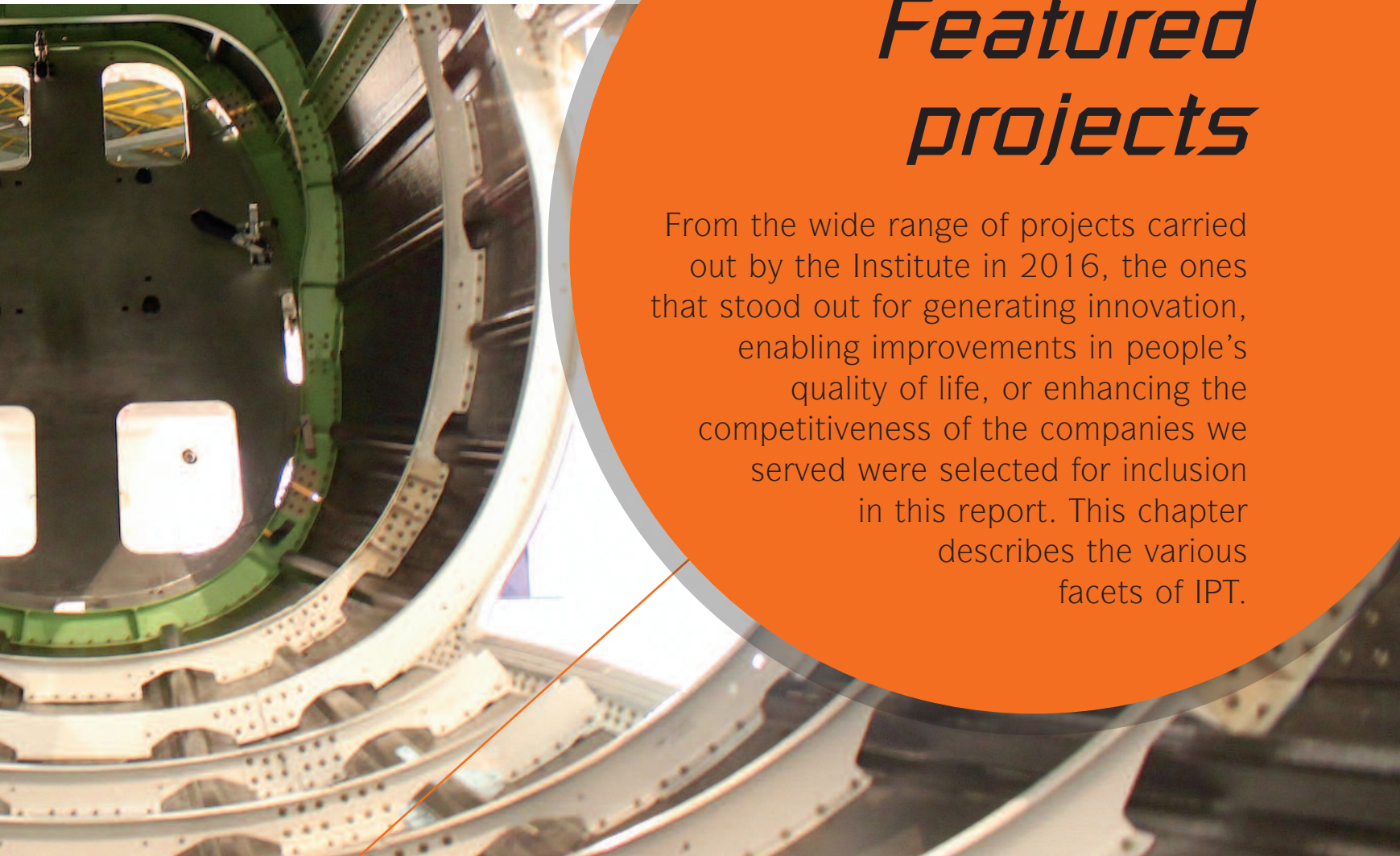
## IPT Valuing Program



Proposed by the group Intellectual Capital, the IPT Valuing Program was established in 2016. The purpose of this annual event is to encourage innovation at IPT through the dissemination of current good practices and the recognition of professionals that stand out during the year, based on indicators predefined jointly by the committee of the program and the People Management Coordination Office. Eight teams and 28 people were honored during the event.







## *Featured projects*

From the wide range of projects carried out by the Institute in 2016, the ones that stood out for generating innovation, enabling improvements in people's quality of life, or enhancing the competitiveness of the companies we served were selected for inclusion in this report. This chapter describes the various facets of IPT.

*Diversified competencies in multiple Technology Centers*

The numerous services IPT makes available to society are arranged in nine Technological Centers and three Groups containing 39 highly specialized laboratories and sections.

*Center for Technology of the Built Environment (CETAC)*

Building Systems and Components Laboratory (LCSC)

Fire and Explosion Safety Laboratory (LSF)

Building Installations and Sanitation Laboratory (LIP)

Environmental Comfort and Building Sustainability Laboratory (LCA)

*Center for Forest Resource Technology (CTFloresta)*

Trees, Woods and Furnitures Laboratory (LAMM)

Pulp and Paper Laboratory (LPC)

Packaging and Cargo Systems Laboratory (LEA)

Forest Resources Sustainability Section (SSRF)

*Center for Infrastructure Construction Technology (CTObras)*

Structural Engineering Section (SEE)

Geotechnics Section (SG)

Construction Materials Laboratory (LMCC)

Mineral Resources and Ceramic Technology Section (SRM)

*Center for Chemistry and Manufactured Goods (CQuim)*

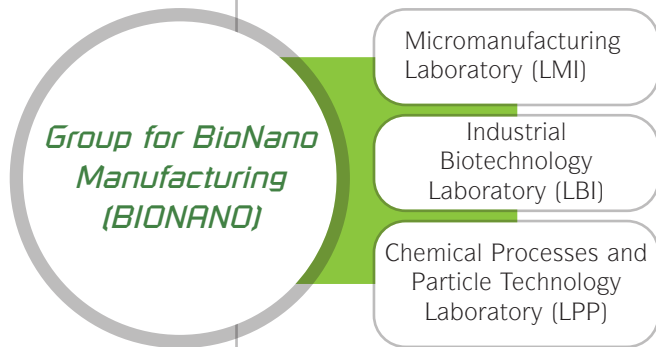
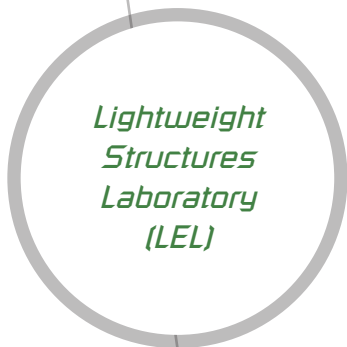
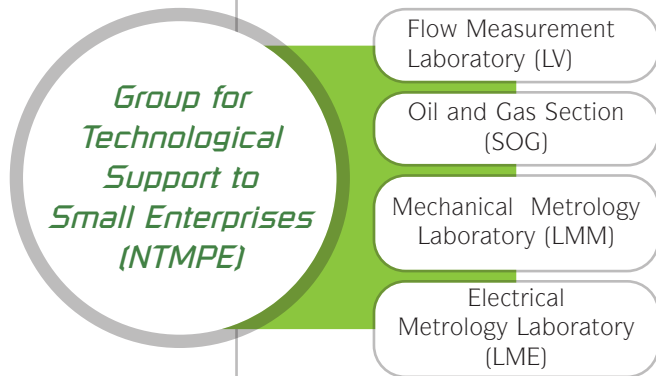
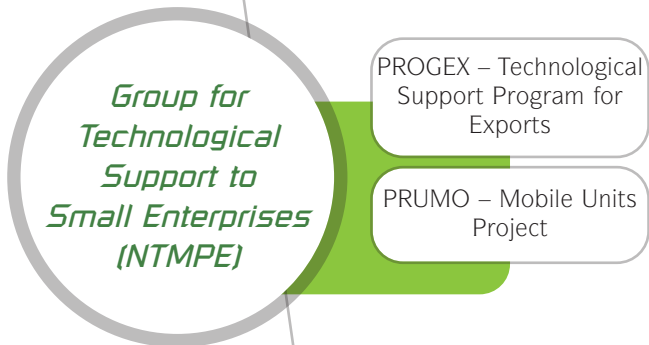
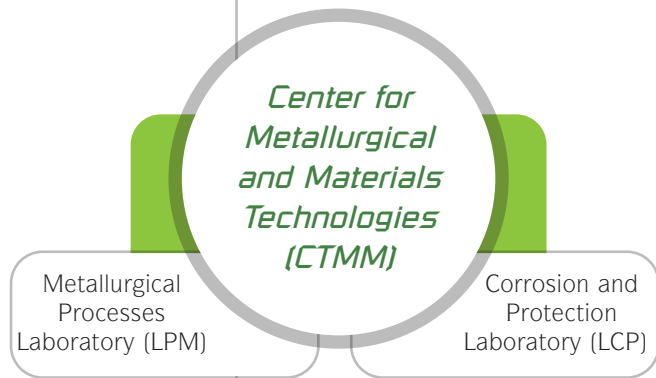
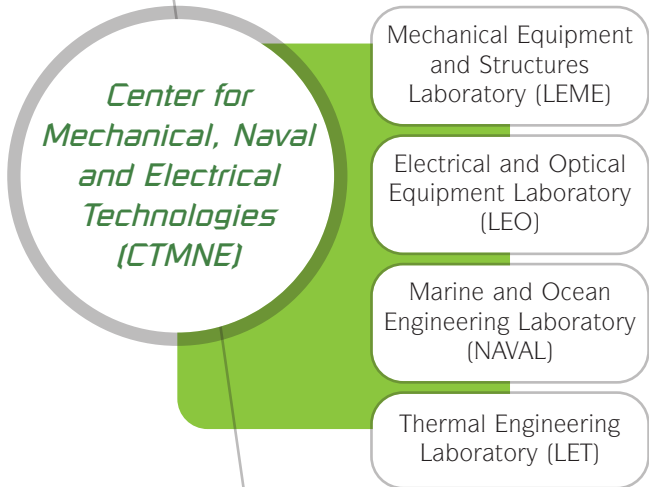
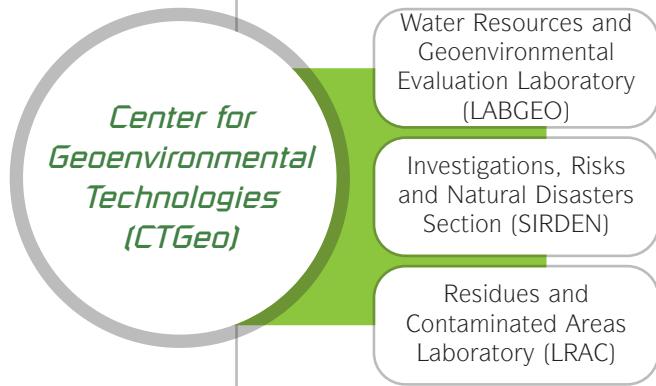
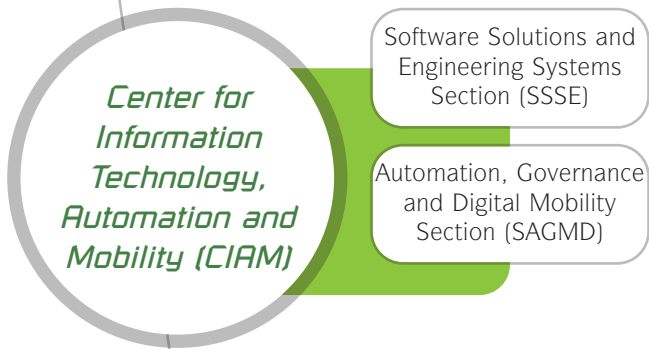
Textile Technology Laboratory (LTT)

Footwear and Protection Products Laboratory (LCPP)

Metrological References Laboratory (LRM)

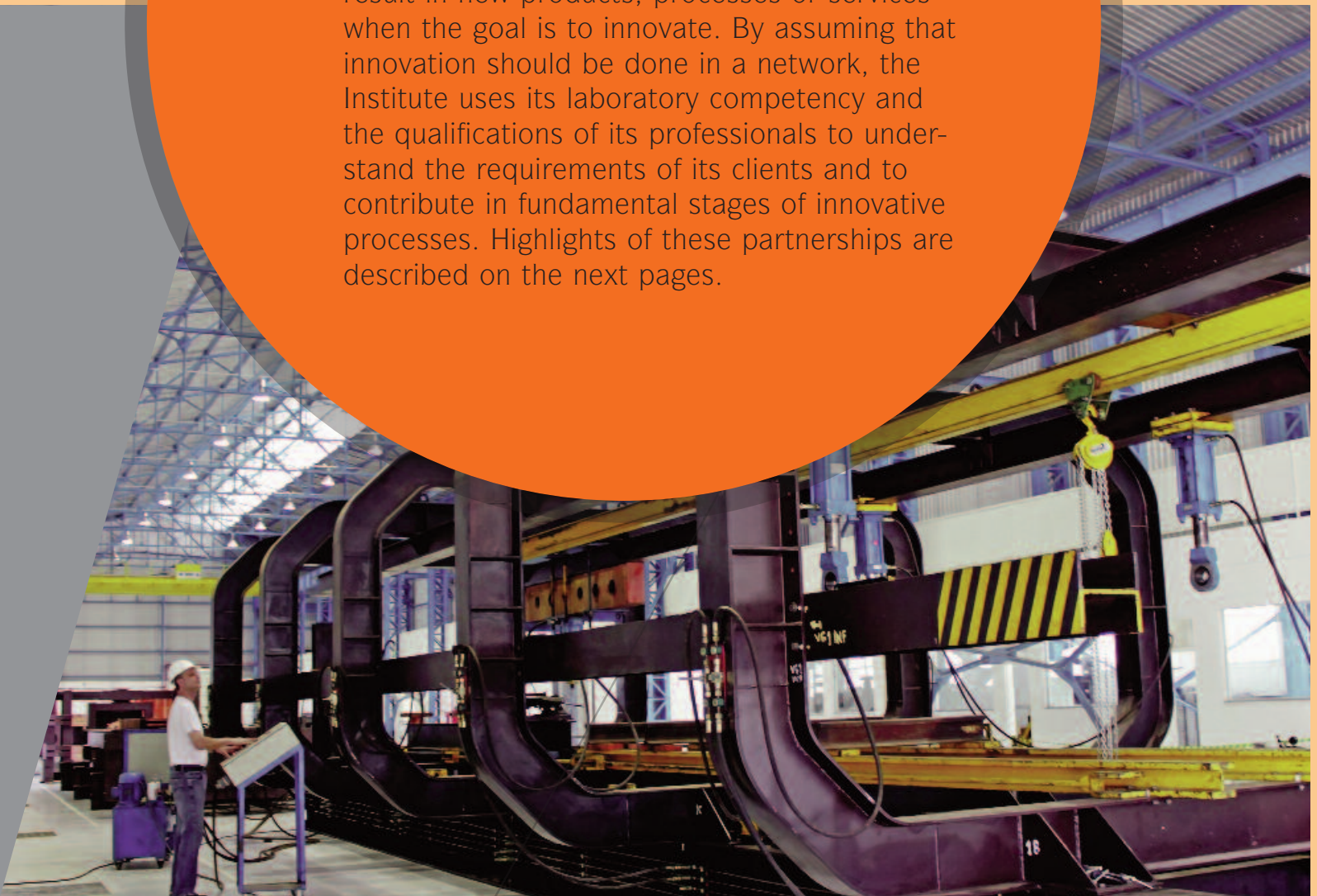
Fuels and Lubricants Laboratory (LCL)

Chemical Analyses Laboratory (LAQ)



## *Industry: an environment conducive to innovation*

IPT has established itself as a partner of industry, an environment conducive to ideas that result in new products, processes or services when the goal is to innovate. By assuming that innovation should be done in a network, the Institute uses its laboratory competency and the qualifications of its professionals to understand the requirements of its clients and to contribute in fundamental stages of innovative processes. Highlights of these partnerships are described on the next pages.



# Additive Manufacturing

Prostheses tailored to the needs of each patient. That is the aim of the project – innovative from multiple aspects – that IPT is developing in partnership with the Brazilian Mining and Metallurgy Company (CBMM), the Brazilian Company for Industrial Research and Innovation (EMBRAPPI), the Association for Assistance to Disabled Children (AACD) and the São Paulo Research Foundation (FAPESP).

The project seeks to address the difficulty of fitting current implants to each patient. Through additive manufacturing and based on exams such as tomography or magnetic resonance, it will be possible to create three-dimensional designs of implants, which will be 'printed' in the exact dimensions required and will fit into the human body without the need for modifications.

The manufacturing technique to be employed, which is the selective laser melting, is a process whereby the most diverse materials can be applied layer by layer to produce a part without the existence of a mold or tool, but necessarily by means of a CAD/CAM system.

The IPT team will focus on the production of the materials to be used, i.e., Nb-Ti (niobium titanium) and Ti-Nb-Zr (titanium niobium zirconium) alloys. The innovation of this project lies in the use of the additive manufacturing process applied to these special metallic alloys.

The project is divided into two stages. The first consists of the production of a powder that has all



the necessary characteristics to work with the deposition system, and is estimated to take place within a period of 24 months. The second stage, lasting 18 months, will be the actual additive manufacturing, i.e., the production and characterization of the parts, including corrosion and cytotoxicity and mechanical resistance tests, such as fatigue in synovial fluid – a substance that lubricates and nourishes the cartilage and bones in the joint capsule, reducing the friction between the structures of the body.

● Metallurgical Processes Laboratory



## *Investigation of a flowslide in Amapá*

The mining company Anglo Ferrous Amapá hired IPT to investigate the causes of a flowslide that occurred on the banks of the Amazon River, which resulted in the submersion of 16,000 m<sup>2</sup> of land it owns in the mining port of Santana, state of Amapá. The Institute determined that the mechanism of the accident consisted in the liquefaction of soil that started on the southwest edge of the embankment built in the mid-1950s, followed by a flowslide that produced mechanical waves underneath and inside the embankment. Upon evaluating the kinetic mechanisms of the accident (speed and direction of motion), the investigation led to important conclusions elucidating the causes of this rare mass movement on the banks of the Amazon River. tipo raro nas margens do Amazonas.

● **Investigations, Risks and Natural Disasters Section**

## *Evaluation of the hygrothermal performance of facades*

Brazilian construction companies will soon be able to count on a new technological service to evaluate the hygrothermal performance of building facade cladding systems while still in the design phase, considering the climate context of the region of the building site. The purpose of this evaluation is to avoid the risk of pathologies occurring due to rainfall or condensation on building facades by allowing for interventions before construction actually begins. IPT is developing a study for the use of a computational tool to simulate transient hygrothermal behavior (in which heat and moisture flows change over time at several points along the elements of a building). The tool will serve to analyze the moisture transport mechanisms in materials that comprise the facade cladding system, such as building components, elements and systems. Simulating hygrothermal behavior involves the use of mathematical techniques used in computation, which enable the process of heat and moisture transfer in the materials of a real construction system to be imitated, thus allowing for sensitivity studies regarding composition, properties of the material and climate conditions. This methodology is faster, more accurate and its cost is lower than that of traditional laboratory tests, which require the construction of building prototypes and are more time-consuming. The research yielded significant gains when one of the researchers participated in the Overseas Development and Training Program (PDCE) offered by IPT at the Faculty of Engineering of the University of Porto, Portugal, where he increased his knowledge about the use of a computational tool to simulate transient hygrothermal behavior.

● **Construction Materials Laboratory**

## Calcined clay in cement

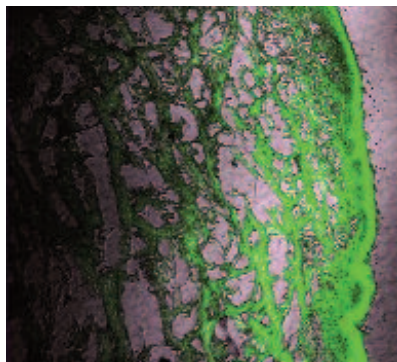
Altering the color of calcined clays to obtain gray pozzolans for addition to cement was the solution IPT came up with to avoid the market's distrust of the reddish hue of clays, which negatively affects the perception about the quality of Portland cements. Based on a study of Portland composite cement (CP II-Z) and Portland pozzolana cement (CP IV), both containing added pozzolana, IPT demonstrated that cement kilns can calcine clays under suitable process conditions to obtain the gray shade without changing the products' performance. The result is that the end consumer will continue to receive cement with the traditional color and the same quality, in line with the regulatory parameters. The study will also broaden the range of clays for possible use as pozzolans, since color will no longer be an deterrent.

- Construction Materials Laboratory

## Nanostructured phytocosmetics

Nanotechnology for the cosmetics industry is becoming one of IPT's specialties. In support of the company Nanofitotec, which developed a dermocosmetic anti-aging product called Nanolinn within the context of the Brazilian Company for Industrial Research and Innovation (EMBRAPII), the Institute offers its expertise in micro and nanoencapsulation processes. Nanoencapsulation improves the cosmetic properties of *Centella Asiatica* extract, a medicinal herb, against degradation processes, as well as its chemical stability. It also facilitates the process of permeation of the active ingredient into the skin through controlled release. Innovative nanotechnology based on phytocosmetic products such as Nanolinn will be particularly beneficial for people with problems or difficulties in using synthetic drugs because of their side effects or their toxic reactions.

- Chemical Processes and Particle Technology Laboratory



## Technical standard for mortars

Continuing its long-standing tradition of supporting the Brazilian Association of Technical Standards (ABNT), IPT participated actively in drawing up a regulatory text that establishes the requirements and performance criteria for decorative inorganic mortars for building coatings. The standard, which is currently under consultation by society, was prepared based on the guidelines of the National System of Technical Approvals (SINAT) developed by IPT and still valid. The document contains relevant innovations, since it establishes requirements and minimum performance criteria for this type of mortar, thereby aiding the user in selecting the product, and also establishing the acceptable conditions for coatings applied on building facades. In response to a request by the Brazilian Association of Industrial Mortars (ABAI), which found that the sector lacked specifications for the product, IPT contributed by ensuring greater technological control during the preparation of the coating, reducing stages at the construction site, enabling the mechanization of application steps and minimizing preventive maintenance costs.

- Construction Materials Laboratory

## Paper nanofibers

In partnership with researchers from the University of Araraquara (Uniara), IPT is developing a technological initiation project aimed at determining how cellulose nanofibers affect the properties of sheet paper produced in the laboratory using industrial bleached eucalyptus pulp. These nanofibers come from cellulose pads obtained by the biosynthesis of bacteria of the genus *Acetobacter*. This study is groundbreaking because it examined the feasibility of using microbial cellulose nanofibers as a paper reinforcement material.

- Pulp and Paper Laboratory

## Microencapsulation in tires

Extending the service life of tires is one of the benefits of the innovative Artap project, which IPT develops with the company Pirelli, within the scope of the Brazilian Company for Industrial Research and Innovation (EMBRAPII). The aim is to develop a temperature regulating agent based on microencapsulated particulate material for insertion in rubber tires. The first phase of the project consisted of developing the particulate material containing phase change material (PCM) and demonstrating the material's efficiency in reducing the temperature fluctuations of the rubber compound. The next stage of the project involves the production of the particulate material on a sufficiently large scale for insertion in tires and of testing them under realistic conditions of use. The future use of PCM-containing particulate material as a component in the formulation of one or more product lines will yield substantial advantages, increasing their service life.



- Chemical Processes and Particle Technology Laboratory



## Cancer fighting technology

The Institute is working on a process to produce a new biopharmaceutical product for the national pharmaceutical industry. In partnership with the company União Química and the Butantan Institute, and with funding from the Brazilian Development Bank (BNDES), IPT is carrying out the mathematical optimization and scale-up of the manufacturing process of Amblyomin-X, a protein with antitumor properties discovered in the saliva of the Cayenne tick (*Amblyomma cajennense*) by the Butantan Institute. The objective is to obtain high concentrations and sufficient quantities of the substance to make its industrial production technically feasible, which will allow preclinical tests with the protein to be performed. This technology was transferred to 10-liter bioreactors in October 2016, but the final delivery, which is slated for 2018, calls for scale-up to bioreactors of up to 100 liters.

- Industrial Biotechnology Laboratory



## *Magnets in Brazil*

After successfully producing the first 100 grams of metallic didymium in Brazil, the Brazilian Mining and Metallurgy Company (CBMM) and IPT took another step towards Brazil's use of its rare earth reserves for the manufacture of magnets, which are key elements in the production of wind turbines, hybrid and electric cars and electronic devices. The next stage of the project consists in producing didymium-ferroboron alloy, the essential material of high performance magnets. After extracting the mineral ores, the rare earths are concentrated, the oxides are produced and the didymium is obtained, which has already been carried out in the previous stage. Having produced the alloy, the third and last stage is carried out, i.e., the production of the alloy powder and the magnet on a laboratory scale. Brazil, which has the world's second largest deposits of rare earth elements, can benefit from this project by ensuring the domestic production of magnets and exporting a key product to high technology companies.

- **Metallurgical Processes Laboratory**

## *Partnership with Petrobras*

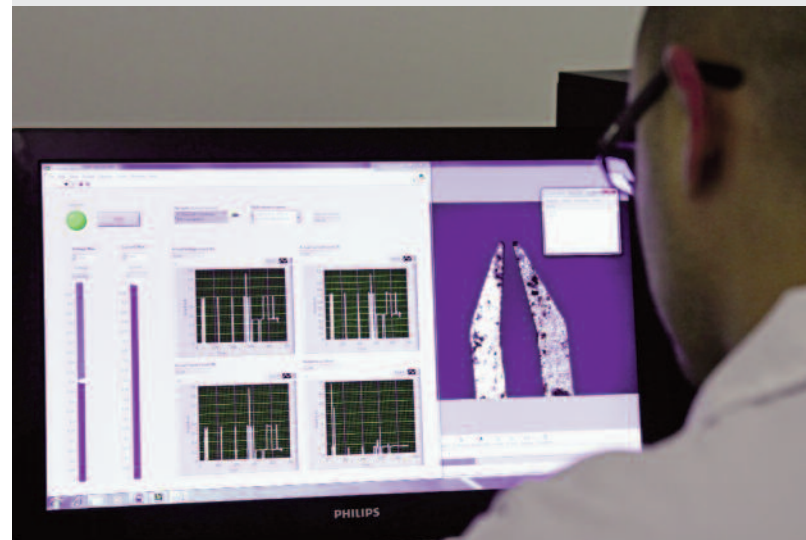
IPT has contributed to corrosion and protection studies in partnership with Petrobras for over 15 years, particularly with the Leopoldo Américo Miguez de Mello Research Center (Cenpes), focusing on the development of new materials, new methodologies and the search for solutions to optimize and potentiate the company's production process. In late 2016, the two institutions formalized another cooperation agreement, focusing on the definition of methodologies to evaluate the cleaning and entrainment efficiency of "PIGs" (devices introduced into a pipeline or polyduct that travel freely through it, driven by the flow of the product), as well as their influence on the monitoring of internal corrosion of pipelines, on corrosion rates and on studies of the kinetics of corrosion stabilization. Since 2006, more than 30 projects have been or are being developed by the two institutions.

- **Corrosion and Protection Laboratory**

## *Microgrippers*

In a project with the Ministry of Science, Technology, Innovations and Communications, IPT is working on the manufacture of an electrothermo-mechanical microactuator for the manipulation of deformable elements in the order of 10  $\mu\text{m}$ -100  $\mu\text{m}$  in diameter – the so-called microgripper used for the characterization of nanoparticles in the laboratory. The process, slated for completion in 2018, includes topology optimization algorithms, devices in metallic substrates and micromachining processes, and provides an innovative solution to meet the challenging requirements of various areas of industry and academia, such as the development of microsystems, semiconductor technology, materials science, micromedicine and biotechnology, manipulation of microorganisms in liquid media, and automation of micromanipulation and microassembly tasks.

- **Micromanufacturing Laboratory**





## *Multiphase flow and corrosion*

Since 2015, IPT professionals have been developing a project with the oil company Repsol, involving studies of the localized and generalized corrosion behavior of API 5L steel, seeking to simulate the typical conditions of exposure of oil well and multiphase flow systems, i.e., two or more fluids with different properties moving through the same pipeline. The purpose of this work is to shed light on the behavior of this material in media containing water, oil, carbon dioxide and hydrogen sulfide at different concentrations, pressure, temperatures and under multiphase flow.

- Corrosion and Protection Laboratory

## *Tags for the management of railroad sleepers*

To increase the logistics efficiency of the railroad company Companhia Paulista de Trens Metropolitanos (CPTM), IPT studied the use of radio frequency identification (RFID) technology as an innovative support tool for the management of sleepers. Based on experimental laboratory tests and tests in the company's yard, IPT developed two software programs: one for reading the electronic tags (tags) attached to the sleepers that pass through the forklift portal and another for the management of these pass throughs. The RFID technology made it possible to ensure the traceability of sleepers and to control sleeper inventory. Therefore, the use of RFID was made permanent, with benefits ranging from ensuring the durability of sleepers from suppliers to the disposal of sleepers removed from the railbed.

- Software Solutions and Engineering Systems Section, Automation, Governance and Digital Mobility Section, and Trees, Woods and Furnitures Laboratory

## *Innovation in aviation*

IPT is beginning to reap the rewards of the investments made in its Lightweight Structures Laboratory, which opened in 2014: a full-scale demonstrator of an executive jet's rear fuselage was produced over the last year, using carbon-fiber skins and stringers. The project was started four years ago, when the laboratory infrastructure was prepared for its execution. The last two years were spent on designing and manufacturing the demonstrator, which was presented in 2016 at the fourth edition of Feiplar Composites & Feipur exhibition. Developments such as this one enable the improvement of manufacturing technologies of composite materials, providing several benefits for the aviation industry, such as the application of more complex geometries in aircraft, reduced fuel consumption due to lighter structures, and lower production costs, given the more integrated structure and thus fewer operations required to produce the end products. The project, which had the support of the Brazilian Company for Industrial Research and Innovation (EMBRAPII), was executed in partnership with Embraer. It focused on enhancing the manufacturing competence of aircraft structures using the automatic lamination process of pre-impregnated carbon-fiber tows known as Automated Fiber Placement. The aim is to help expand the use of carbon fiber in primary aircraft structures in the domestic industry.

- Lightweight Structures Laboratory

## Concrete reinforcement

To examine the performance of different reinforced concrete technologies in the marine environment: that is the focus of the project developed by IPT with Petrobras, slated for completion in 2018. Aiming to protect constructions such as buildings and piers from chloride, the main aggressive agent in this type of environment, this work includes comparing alternative reinforcement materials to carbon steel under controlled laboratory and field conditions (in the municipality of São Sebastião), studying the application of cathodic protection techniques prior to contamination, and using sensors to monitor the penetration of aggressive agents into concrete. The recovery of structures already affected by corrosion using techniques that ensure greater durability after the repair is also within the scope of the project, as well as an economic viability study of the implementation of alternative non-conventional reinforcement in the construction of reinforced concrete structures, which could increase their service life and reduce their cost over time.



● Corrosion and Protection Laboratory

35

Industry

## Cleaner surfboard waxes

Waxes for surfboards and other water sports are traditionally made from paraffin wax, which, because of its fossil and non-renewable source, ends up generating pollution and negatively affecting the marine ecosystem. In order to offer a product with lower environmental impact, the company Parafinaria sought the help of IPT's Cleaner Production Program (Prolimp) to develop formulations with national renewable raw materials that are less aggressive to the environment. IPT developed five wax formulations for different ranges of water temperature using in their composition a large proportion of natural products, such as beeswax and vegetable resin. The tests were performed in a differential scanning calorimeter, which provides information about the material's melting temperature, thus allowing adjustments to be made in the proportions of the components. The waxes were also tested on surfboards to determine how well they spread over and adhered to the boards. The formulations that presented the best performance in the laboratory were tested on the beach. A patent has been filed jointly with the client and the products are already available to consumers, initially in the domestic market.



● Group for Technological Support to Small Enterprises and Chemical Processes and Particle Technology Laboratory



## *Sustainable solutions for cities*

Urban infrastructure is subject to numerous impacts, from both natural phenomena and human interventions. In this context, IPT seeks solutions that offer safety and respect for the environment while prioritizing people's quality of life. Projects in areas such as transport, water and energy consumption, waste treatment and risk prevention are among the highlights of 2016, and the Institute's most innovative ideas are described below.

## *Solid Waste in the Baixada Santista*

The National Solid Waste Policy, which came into effect in 2010, calls for profound changes in the way cities and states manage their solid wastes in the coming years, encompassing innovation, economic viability, sustainability, reuse of resources and social integration. Seeking alignment with this reality, the municipalities of Baixada Santista, aided by IPT's technical, scientific and technological expertise, are making efforts towards understanding the profile of the solid wastes they produce and determining the best alternatives for their disposal and treatment.

The RSU Energia Project (MSW Energy Project), which started in 2015 under the auspices of the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo (SDECTI), aims to research and develop technological solutions for the separation and treatment of municipal solid waste (MSW), and to support municipalities in waste management based on this research and the knowledge acquired therefrom. The city of Bertioga was chosen as a pilot for the evaluation of alter-

natives, whose results will allow for the creation of a plan that could be extended to any municipality, helping municipalities to reduce their waste management costs and use technologies for recovery of materials and energy use.

In 2016, a sample unit of the municipality and the population to be served by the project were defined, and parameters of the composition and properties of the MSW were determined. This collected information will be helpful for the preparation of the basic and conceptual projects of technologies to be installed and operated on pilot and bench scale, which include mechanized sorting, anaerobic digestion and complete combustion equipment.

Also in 2016, another important step was taken in the region: with funds from the State Water Resources Fund (Fehidro), IPT was tasked by the Metropolitan Agency of Baixada Santista (AGEM) to draw up a Regional Integrated Solid Waste Management Plan for the Baixada Santista region, seeking solutions for proper waste management in the region, considering environmental, economic and social aspects and with the involvement of society as a whole.

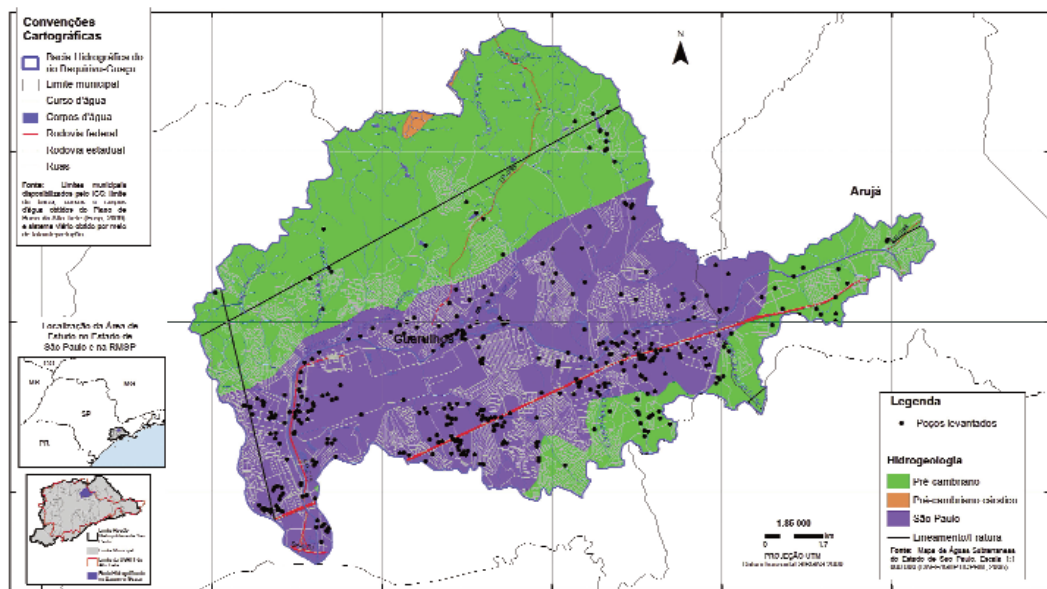
The project, which is expected to be completed by January 2018, includes nine municipalities – Bertioga, Cubatão, Guarujá, Itanhaém, Mongaguá, Peruíbe, Praia Grande, Santos and São Vicente. In addition to conducting studies and proposing solutions regarding the generation, composition, collection, disposal and treatment of municipal solid waste, there are plans for the organization of workshops and public hearings to disseminate information, so that decisions can be made jointly with the population.

● **Residues and Contaminated Areas Laboratory**

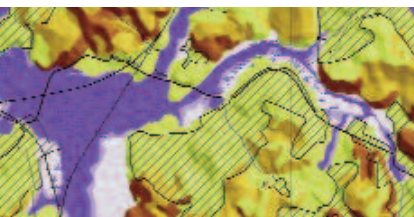


## -Management of groundwater resources

In a project for the Fundação Agência da Bacia Hidrográfica do Alto Tietê (Upper Tietê River Basin Foundation Agency), IPT is performing a diagnostic analysis of the Baquirivu-Guaçu River basin in the municipalities of Guarulhos and Arujá, in order to assist in the proper management of the region's underground water resources. Scheduled for completion by the end of 2017, the study includes a survey of registered wells, hydrological data, potential sources of contamination and reportedly contaminated areas, as well as a number of chemical analyses. The aim is to characterize the quantity and quality of groundwater and to propose the delimitation of areas to be restricted and controlled, if such need is confirmed, based on the activities developed in the municipalities. In a scenario of intense population growth, this work is essential for adequate environmental management and the prevention of possible water shortages in the region.



### ● Water Resources and Geoenvironmental Evaluation Laboratory



## Guidelines for the preparation of geotechnical charts

The municipalities have received substantial assistance to meet the requirements of Federal Law 12,608/2012, which instituted the National Policy on Civil Protection and Defense, with the launch by IPT of guidelines to better understand and use geotechnical charts in territorial planning and in disaster prevention in cities. These charts, which are cartographic documents containing details of the physical environment and its geodynamic processes, indicate its limitations and potentialities, and offer guidelines for their use in urban land division and other forms of land occupation, including the use of aggregates for civil construction. Such charts are essential, especially for cities with areas susceptible to landslides, flooding and other phenomena that may give rise to natural disasters. In addition to the guide, the Institute drew up geotechnical charts for the urbanization of the municipalities of Monteiro Lobato, Conchas and Praia Grande, all in the state of São Paulo, containing details of the main features of the physical environment as they pertain to land use and occupation in each city, thus providing relevant information for conscious urban expansion.

### ● Water Resources and Geoenvironmental Evaluation Laboratory and Investigations, Risks and Natural Disasters Section

## *Mine tailings dams*

The objective of a multidisciplinary working group led by the Department of Energy and Mining and which included IPT was to make a diagnosis of the mining and mineral processing dams in the state of São Paulo and to recommend solutions to minimize their risks. A survey was made of the situation of the 22 dams included in the scope of the National Dam Safety Policy in the state, and their methods of construction and monitoring, their processes of transformation and generation of waste were evaluated, as were emergency and accident prevention procedures. After visits to the sites, meetings and technical seminars, the group finalized its report, which included recommendations about legislation and technical standards, a dam monitoring and inspection system, construction technologies, reduction of tailings, and emergency action plans. IPT's participation consisted mainly of the presentation of technologies and equipment to monitor the structure of the dams, and of the proposal of solutions for tailings treatment, and risk management.

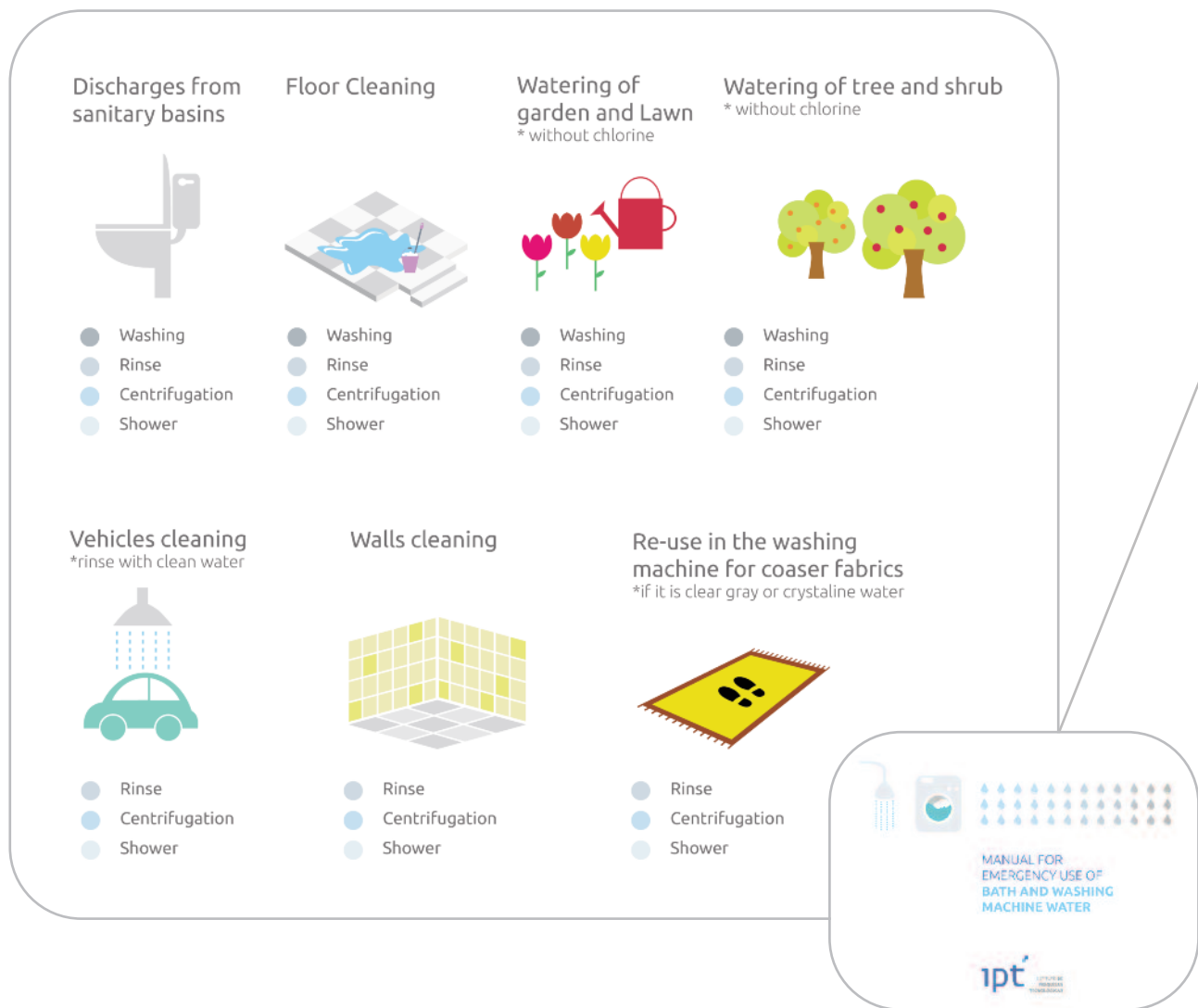
- **Water Resources and Geoenvironmental Evaluation Laboratory, Investigations, Risks and Natural Disasters Section, Mineral Resources Section, Geotechnics Section, Metallurgical Processes Laboratory, and Construction Materials Laboratory**



## Manual for graywater reuse

Disseminating technology among the population is one of the objectives of the Institute, which has published a manual containing guidelines for the reuse of bathwater and washing machines, called graywater. Aiming at more sustainable actions, the manual outlines the multiple non-potable uses of graywater and offers several good practices for its management in the domestic environment. The solutions for graywater collection, storage and use are simple, do not require the construction or installation of special equipment, and can be adopted in all households.

### ● Building Installations and Sanitation Laboratory





## *Risk reduction in Salvador*

Throughout 2016, IPT provided expert risk reduction advice to Salvador, the capital of the state of Bahia. The city received specialized technical support for the creation and implementation of its Municipal Slide and Flood Risk Reduction Plan and its Civil Defense Preventive Plan. In addition to containment actions, the work involved training, community awareness raising and living with risk. An innovative element of the project was the use of knowledge platforms based on information technology, which help control big data, facilitating the combination of plans and allowing for long-distance control of real time information.

● **Investigations, Risks and Natural Disasters Section**

## *Águas da Prata mine planning*

Directly affected by the mineral occurrences of the rocks comprising the Poços de Caldas alkaline massif, the municipality of Águas da Prata turned to IPT to draw up a set of information plans in the form of thematic maps that were used to devise the Mining Zoning Model for the municipality. The work provides supporting evidence for the effective inclusion of mining activities in the municipal plans, rendering mining compatible with other forms of land use and occupation, taking into account local environmental constraints and current legislation. IPT's advisory work also resulted in the suggestion to establish a complementary municipal law proposing that the mining zoning carried out in the project be linked with the Águas da Prata Master Plan.

● **Mineral Resources Section**



## *Recovery of PPAs*

The purpose of the work carried out by IPT for the municipality of Limeira as part of the Technological Support Program for Municipalities (Patem) of the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo was to promote the recovery of Permanent Preservation Areas (PPAs) to favor water production in the Ribeirão Tabajara subbasin. The project consisted in the environmental characterization of the APPs based on the description of their geological and pedological features, the state of conservation of forest fragments and the characteristics of flooding, drainage and natural regeneration of the vegetation in the area. Based on this characterization, a protocol was prepared containing proposals of recovery projects for PPAs located in rural properties. The difficulty of making an environmental diagnosis of an extensive area with limited time and resources led to an innovative solution: the subbasin was divided into hydrographic compartments whose behavior differs in terms of the development of erosion and silting processes and the generation of direct runoff. Based on this division, priority areas for field work were selected so as to identify the environmental conditions in the subbasin. This allowed for the optimization of available resources to obtain the information needed to define the main environmental conditions in the hydrographic compartments that would affect the current status of the PPAs in the studied area under study.

- **Forest Resources Sustainability Section and Investigations, Risks and Natural Disasters Section**



## *Waterway development of the North region*

Brazil lacks an adequate transport infrastructure for its agricultural production. This means that the country's highly efficient grain (soybean, corn, etc.) production system is negatively affected by logistic problems. In search of solutions, large companies linked to agribusiness have sought out the technological expertise of IPT to rethink and boost shipping in Brazil's north region. Grain producers and transportation companies such as Cargill and Hidrovias do Brasil have allocated investments to assess waterway safety in the region, especially in the Tapajós, Madeira and Amazonas rivers, which are routes from which cargo can be shipped out more efficiently; large river fleets may ship up to 30 thousand tons of cargo (equivalent to more than 1,000 road trucks) in a single trip. With more than 60 years of experience in the field, IPT's studies, whose scope often includes incremental innovations, range from the optimization of spaces shared between large vessels in tight locations where cargo loading and unloading terminals are concentrated to theoretical and experimental evaluations of the performance of each fleet formation used in the region's rivers. The results of instrumented trips, in which the performance in terms of safety and mechanical efficiency of the fleets are examined, as well as predictive studies of the vessels' behavior in emergency situations, have been used by the Navy to assess the cargo transport safety of each type of river fleet in northern Brazil.

- **Marine and Ocean Engineering Laboratory**

## *Efficient use of water and energy*

Between 2015 and 2017, IPT professionals evaluated aspects pertaining to water and electricity consumption in public buildings and public lighting levels of 10 municipalities in the Ribeira valley. This work, which involved the cities of Cajati, Cananéia, Eldorado, Iguape, Ilha -Comprida, Itariri, Jacupiranga, Pedro de Toledo, Registro and Tapiraí, focused on encouraging the monitoring of water and electricity consumption levels in order to underpin the selection of policies and measures aimed at reducing losses and wastefulness. Based on the evaluations requested by the Department of Economic Development, Science, Technology and Innovation of the State of São Paulo, lines of action were formulated to improve water and energy efficiency, which will culminate in the reduction of water and electricity expenses and improvements in public lighting, based on the technical and economic analysis of the substitution of sodium vapor lamps in public lighting fixtures for more efficient technologies, such as LED. The study helps municipal administrations to understand that activities of low complexity, such as encouraging behavioral changes and rationalizing resources, expeditious maintenance processes, communication between municipal governments, and closer attention during the design phase of buildings and urbanization, can yield significant results in efficiency over time, which may lead to their inclusion in the master plans of the respective municipalities. Innovative tools were also created for georeferencing information on consumption and a prototype for cloud access by municipal account managers, which are technologies to help municipalities implement the measures proposed by the Institute.


- **Building Installations and Sanitation Laboratory, and Electrical and Optical Equipment Laboratory**

## *Safety for Rio's LRV*

The partnership that IPT has been developing with Rio's LRV (VLT Carioca), the light rail vehicle linking Rio de Janeiro's port area to the city's financial center and to Santos Dumont Airport, aims to increase safety for users and as well as for the transport structure. By conducting studies and measurements to identify cases of electromagnetic interference between systems, this work is aimed at preventing failures in train control and traction, and at proposing corrective measures. Innovative solutions were used in the simulations of interference in the direct current supply through underground cables, improving the safety of the LRV's operation.

- **Electrical and Optical Equipment Laboratory**





*Metrology: from precision to performance, supporting excellence in the public and private sectors*

IPT's long tradition in the field of metrology, which involves measurement, calibration, assaying, testing and standardization services, does not allow the Institute to remain in a comfort zone. Innovation is a significant presence in metrology at IPT, which works tirelessly to improve the thousands of services available to a wide range of clients, and to create on-demand solutions that support its partners' innovative actions. Check out the metrological highlights of 2016 on the next pages.



## *Innovation in oil and gas testing*

Brazil received its largest traction machine upon the launch, in December at IPT, of an anchor element testing system (AETS) for equipment used in oil and gas production on floating units, such as ships and offshore platforms. The system will be used in the development of high load capacity mooring devices made of metal and polymer materials. These devices can also be developed and qualified by testing with the umbilical and risers system for deepwater drilling, as well as steel cables and belts for handling and lifting heavy loads.

The system, which is part of the technology of IPT's Mechanical Equipment and Structures Laboratory, has a static load capacity of up to 2,600 tf (ton-force), corresponding, for example, to the force required to stack 2,600 small cars, and a dynamic load capacity of 1,300 tf. The system is the result of a partnership involving Petrobras, which made resources of R\$ 10.7 million available for the development of the project and purchase of equipment, and the São Paulo State Government, which invested R\$ 5 million for the design and the management of the implementation, in addition to putting up a building on the campus of the Institute.

IPT was responsible for conceiving the testing system, for creating its basic design, coordinating the detailed design, drawing up its purchase specifications, developing suppliers, coordinating its assembly, integrating the subsystems, and for final commissioning of the testing system. There are only two other systems in the world with features similar to the one built at the Institute, and they are located in Houston (USA) and Bergen (Norway). This AETS is the single one in the southern hemisphere, so it offers a new technology to more than just the Brazilian market. Its main usefulness is that it supports deep-water drilling, which requires both static and dynamic anchoring elements.

The building that houses the system has a total of 3,000 square meters and a height of 12 meters. It is also equipped with two 16-ton bridge cranes installed at a height of 10 meters. The building also has an engine room for the complete hydraulic system, electrical substation and control room. The floor of the operating areas is coated with a high strength material.

● **Mechanical Equipment and Structures Laboratory**

## *Development of wood products*

In 2016, IPT renewed its technology assistance agreement with the Brazilian Association for Mechanically Processed Timber (ABIMCI), whose aim is to exchange and update information on production processes, inputs, designs and technical standards for wooden doors for buildings. This partnership has enabled the forms of quality evaluation in the market to be standardized, thus helping companies to adjust their products in cases of non-compliance and to optimize them with the support of the Institute's scientific and technological expertise.

● **Building Systems and Components Laboratory**

## *Partnership for the quantification of lead, cadmium and mercury*

It is crucial to identify the presence of lead, cadmium and mercury in batteries, not only to minimize their negative impacts on the environment but also to adapt Brazilian production to international trends and to enable the export of these products. IPT, which was already performing these tests, optimized its work to establish a partnership with CPqD (Center for Research and Development in Telecommunications), an independent institution focusing on innovation. It is now CPqD that opens the batteries and prepares samples, which are complex and expensive steps, while the determination of elements is done by IPT. With this partnership, our clients have benefited through faster delivery of test results.

● **Chemical Analyses Laboratory**



## *Fire protection at Sesc*

To ensure the safety of its users and its buildings, IPT analyzed the facilities and made a detailed examination of the fire protection measures at 40 units of SESC, the Social Service of Commerce organization, in the state of São Paulo. The work performed by the Institute consisted of the technical documentation on fire protection measures that had been previously implemented, such as architectural plans, layouts, designs and emergency plans, as well as on-site inspections at all these units. The analyses ranged from the reaction to fire of the materials used in the units' buildings to laboratory testing of the capacity of fire extinguishers and fire hoses, and the condition of photoluminescent emergency signs. This project gave SESC a new and systemic understanding of fire prevention and fire fighting aimed at ensuring the safety of people and property.

● **Fire and Explosive Safety Laboratory**

## *Technology for quieter buildings*

To help construction companies and flooring and pipe manufacturers improve the quality of their products, reducing noise on floors and in sanitary equipment, three new reverberation chambers, groundbreaking in laboratories in Brazil, were added to IPT's laboratory infrastructure.

The new chambers, which were built by the Institute's researchers, allow for the performance of both impact noise tests on full-scale flooring and noise produced in sanitary equipment, i.e., bathroom sinks, showers and toilet bowls. The tests helped the aforementioned companies to comply with the Brazilian building performance standard NBR 15,575, which requires buildings to have sound insulation not only at external facades but also between private areas.



- **Environmental Comfort and Building Sustainability Laboratory**

## *Steel, ethanol and insulating oils: New Proficiency Programs*

IPT traditionally offers industrial and academic laboratories a variety of Interlaboratory Proficiency Programs to support evaluations of the quality of the chemical analyses and tests on different materials. One of the many benefits for participants of these programs is that they can make covert comparisons of the performance of their lab with that of others. In 2016, the Institute expanded its services in this area, with the inclusion of high alloy steels in its Steel Program, enabling it to meet the requirements of laboratories that analyze stainless steels, steels for the fabrication of molds and tools, and steels for aeronautical and military applications. Another advance was the use of Quality Function Deployment to study new proposals, enabling the creation of programs involving the ethanol chain for the insulating oils and cast iron industries.

- **Metrological References Laboratory**

## *Tests on Olympic balls*

On the eve of the 2016 Olympics in Rio de Janeiro, IPT tested balls identical to those used in the games to understand how their characteristics – external coating material, surface roughness, water permeability, bounce, size and weight – affect the dynamics of each kind of ball game. Seven tests were performed on balls from 12 different sports, since such tests are essential to ensure the balls are standardized and are impartial elements in the results of the game, without favoring or hindering the athletes.

- **Textile Technology Laboratory**



## *Monitoring fuel quality*

The goal of the Fuel Quality Monitoring Program run jointly by IPT and the National Petroleum, Natural Gas and Biofuels Agency (ANP) in São Paulo is to ensure that the gasoline, ethanol and diesel delivered to consumers have the quality necessary for their expected performance. The program, which has been in operation since 1999, covers the metropolitan region, the state's

northern and southern coasts, and the Paraíba Valley, and involves the collection and analysis of fuels at retailers in order to identify and locate products that do not meet the technical specifications established by the ANP's current resolutions. About 280 thousand fuel samples have been analyzed since the program started, and the 13,770 samples collected in 2016 were coded in the IPT laboratories, and subsequently, by assays performed according to the methodologies and specifications specified in the ANP's resolutions. The data are sent to the agency through a web platform system, which enables immediate access to the results. In addition to indicating possible nonconformities at the approximately 3500 fuel stations evaluated each year, the program also draws up general indicators of quality of the fuels sold at the stations, which help the ANP to plan its inspection schedules and also provide information to the agencies for consumer protection, market regulation and environmental protection. In the wake of the Fourth Industrial Revolution, the laboratories responsible for the program intend to work on the development of a georeferencing application that will enable better planning and implementation of field activities and classification of samples, thus reducing costs and streamlining processes.



● Fuels and Lubricants Laboratory, and Chemical Analyses Laboratory

## *Competence and cooperation in engines*

In 2016, the area of engines at IPT's Thermal Engineering Laboratory was granted accreditation by CETESB – the Environmental Sanitation Technology Company of the State of São Paulo – for the approval of internal combustion engines, enabling it to offer tests that prove, with the official seal, compliance of this type of product to the current environmental legislation. The tests meet the parameters of ISO 8178, regulated MAR-I, for agricultural engine and road machine tests, and should be helpful for national and multinational manufacturers aiming to export to Brazil. A joint team was responsible for the tests required for accreditation, resulting from a technological cooperation agreement signed between the Institute and the German engineering company IAV. The purpose of the partnership is to carry out technological research and other joint projects involving engines, fuels and lubricants.

● Thermal Engineering Laboratory







## *Bicycle in the wind tunnel*

Considering that one of the main factors that affect the performance of a cyclist is air resistance, South American triathlete and Ironman record holder Igor Amorelli performed aerodynamic tests in IPT's wind tunnel. The purpose of the tests was to garner data to support posture studies that should reduce the athlete's frontal area, such as the position of shoulders, head and arms on the bike, thereby improving aerodynamics and reducing air resistance (drag). Based on the information collected, the cyclist and his team will also be able to assess the need to reconfigure the bike, albeit keeping in mind the comfort needed to face the Ironman race, which involves biking for 180 km, swimming 3.8 km and running 42.195 km.

● **Flow Measurement Laboratory**

## *Manual on school uniforms*

As a result of a training project that took place in one of the Institute's laboratories in 2016, IPT launched a manual of specifications for school uniforms, aimed at providing technical guidelines to ensure the quality and durability of the school clothing worn by children and adolescents all over Brazil. The manual, whose target audience is producers, suppliers and buyers in the field of public and private education, offers information about the best fabrics for the production of school uniforms and the standard requirements that must be met in terms of composition, color, size, strength, durability and safety. In line with today's context, the researchers also pointed out ways to modernize school uniforms in the country, based on aspects of comfort that take into account the users' health, well-being and practice of physical activities.

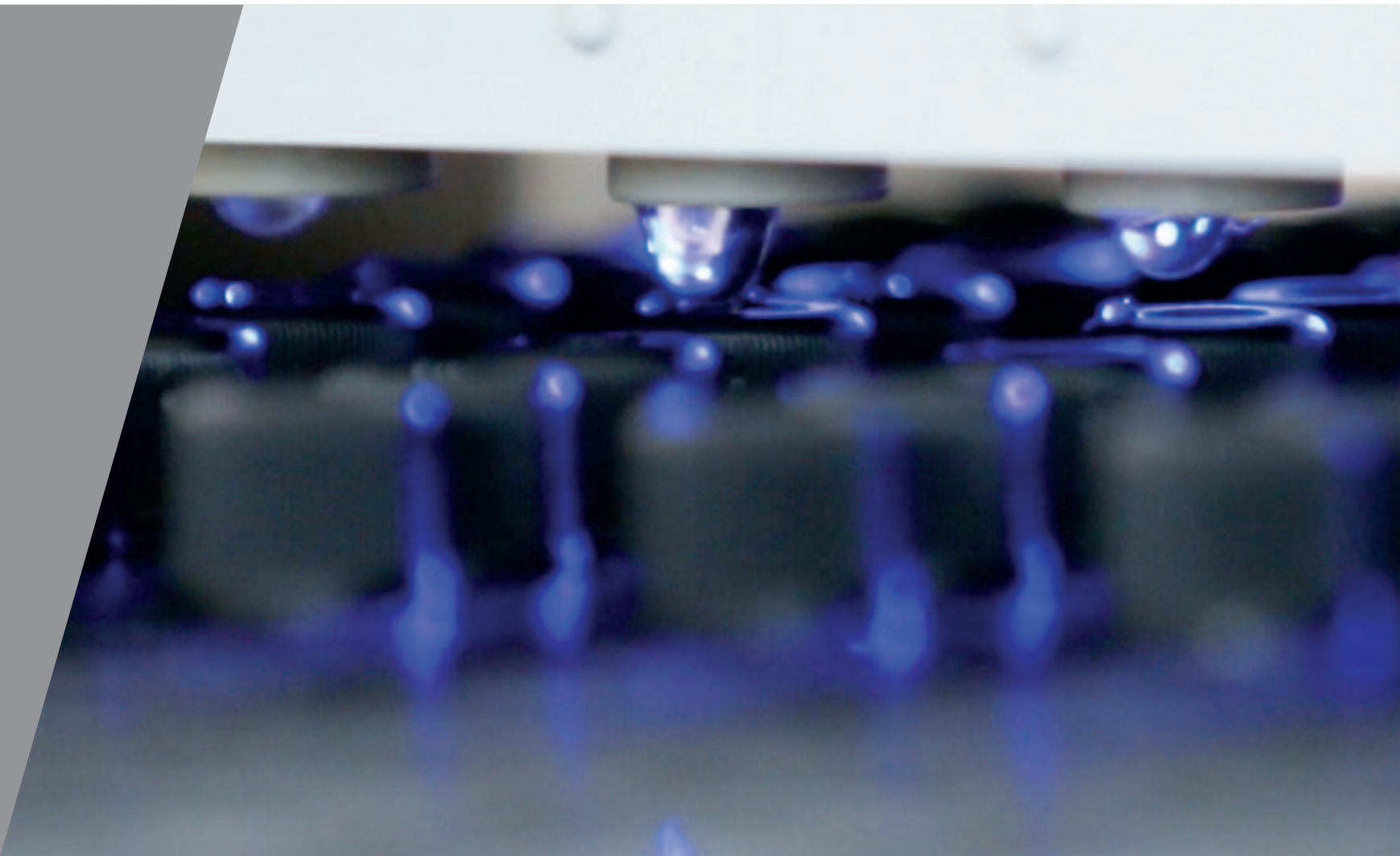
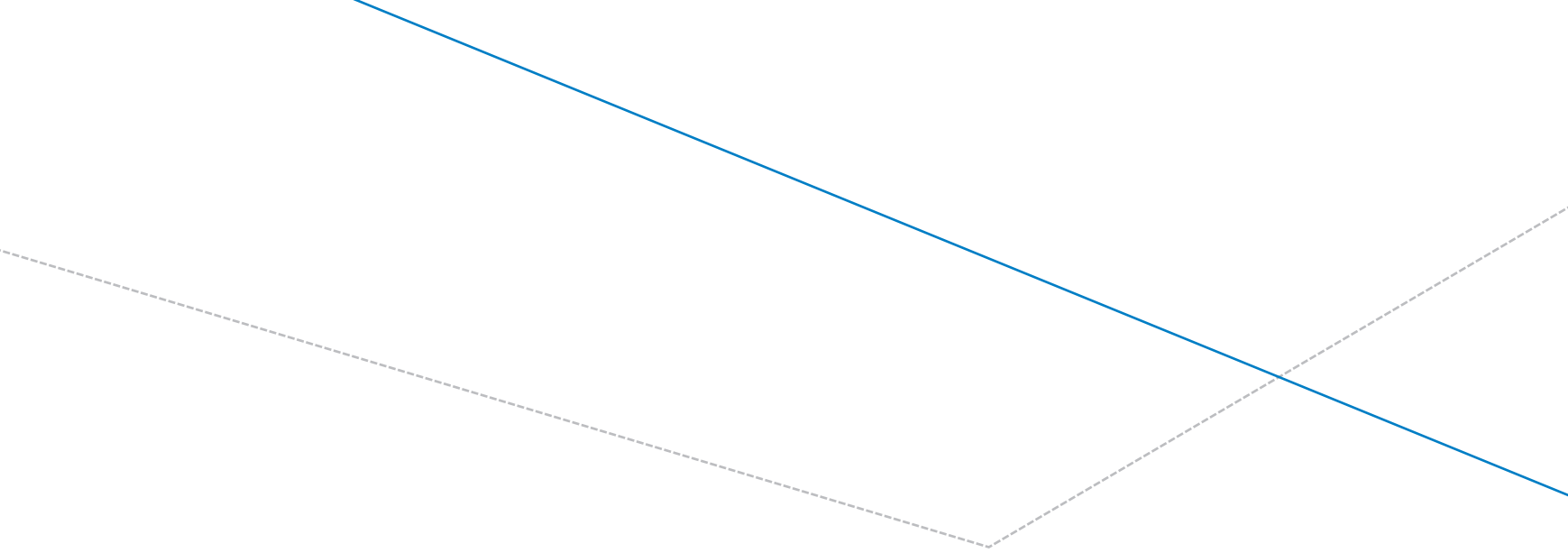
● **Textile Technology Laboratory**

## *Global certification in virtual instrumentation*

IPT's Electrical Metrology Laboratory was certified by National Instruments (NI) to become a calibration center for virtual instruments. Classified as an "NI Certified Calibration Center," the only unit of its kind in South America, the Institute is now serving especially companies in the electronics and automotive industries. A virtual instrument consists of an ordinary microcomputer or workstation equipped with inexpensive software and hardware such as plug-in boards and driver software that, together, perform the functions of traditional measuring instruments. They represent a fundamental shift from hardware-centric systems because they exploit the computing, productivity, display, and connectivity capabilities of popular desktops and workstations.

● **Electrical Metrology Laboratory**







## *FINANCIAL STATEMENTS*

This chapter provides details of the statements and results of IPT, which faced a year of national crisis but still succeeded in presenting a series of positive numbers, such as its record revenue earned through innovation.

# Message to shareholders



IPT succeeded in significantly improving its economic performance in 2016: an 11% reduction in the cost of services and of 6% in administrative expenses offset the 1.7% decrease in gross operating revenue, so that the net result was a loss of only R\$ 1.7 million in 2016, compared to the net operating loss of R\$ 19.6 million in 2015. This improvement is attributed to the São Paulo State Government, which increased its economic subsidy by R\$ 13.5 million, and to IPT's employees, whose understanding of the crisis situation led them to agree to a 10% pay cut, with a reduction of working hours, in the second half of 2016. Nevertheless, IPT had to reduce its staff, ending the year with only 784 employees compared to the 830 at the beginning of the year.

The effect of Brazil's economic crisis on IPT was a 15% reduction in revenues from products and services and of 16% in funding from the federal government. Between private and public sources, the share of its own revenue increased from 54% from private companies in 2014 to 58% in 2016. This indicates that the spending reduction by the public sector was greater than by the private sector during that period. The number of clients served during the year also dropped from 3,700 to 2,500, reflecting the fall in demand in metrology sales, notwithstanding the effort to diversify the offer of tests and calibrations.

A new process of goal setting and results monitoring, with goals linked to Pathways to Innovation, Knowledge Diffusion, Client Relationships, Sales Effort and Financial Results, was implemented to face the crisis and prepare to overcome it.

Thanks to revenue from new tests and the stability of support for business innovation by the EMBRAP II Program, IPT was able to continue operating its current projects and to sign new innovation contracts with companies, contributing to raise its revenues

from innovation to 38% in 2016, coming ever closer to the 40% target in 2018.

For example, a project was started to develop the manufacturing process of orthopedic implants of interest to the Association for Assistance for Disabled Children – AACD, to be manufactured by 3D printing using niobium alloys with mechanical properties very similar to those of bones. This project is sponsored by the Brazilian Mining and Metallurgy Company – CBMM, in the EMBRAP II program. In another project that is part of this program, IPT is developing a device that promotes olfactory experimentation through smartphones, aiming at online perfume sales.

As a continuation of the Institute's modernization program, the Anchor Testing System was launched in the Mechanical Equipment and Structures Laboratory. The system has a load capacity of up to 2,600 tf (ton-force), and its design and construction were sponsored by Petrobras and the São Paulo State Government. The system is already under operation, performing tests for companies that manufacture anchoring elements for offshore platforms.

IPT has been seeking new activities to increase its impact on Brazilian society. Based on actions supported by the Department of Economic Development, Science, Technology and Innovation, IPT is developing a Regional Urban Waste Management Plan for the Baixada Santista region. To better disseminate the developments achieved by the IPT team, the Institute launched its quarterly electronic journal "Revista IPT – Tecnologia e Inovação" (IPT Magazine - Technology and Innovation). It has also redoubled its efforts to promote IPT in the media. The number of news items in which IPT was cited in 2016 increased by 50%, i.e., from 1,500 to 2,400. Among these items, the percentage dealing with innovation increased from 9 to 18% in the past year.

## BALANCE SHEET

*as of 31 December 2016 and 2015 (in thousands of Reais)*

ACTIVE	2016	2015	PASSIVE	2016	2015
<b>CURRENT ASSETS</b>			<b>CURRENT LIABILITIES</b>		
Cash and cash equivalents	8,798	4,315	Suppliers	3,181	4,983
Financial investments linked credits	25,332	29,541	Salaries payable and charges payable	5,303	5,699
Receivables	8,724	8,150	Taxes and contributions payable	6,634	2,999
Advances to employees and third parties	2,662	332	Advances from clients	1,780	3,575
Prepaid and recoverable taxes	10,180	10,408	Obligations payable - vacations and social charges	13,017	11,580
Inventories	239	328	Tax installments	5,230	5,075
Expenses paid in advance	130	28	Government subsidies - Development		
Compulsory deposits	349	351	Agencies	20,893	30,110
Other receivables	14	5	Other current liabilities	223	190
<b>Total Current Assets</b>	<b>56,428</b>	<b>53,458</b>	<b>Total Current Liabilities</b>	<b>56,261</b>	<b>64,211</b>
<b>NONCURRENT ASSETS</b>			<b>NON-CURRENT LIABILITIES</b>		
Long-term receivables	386	348	Tax installments	9,358	12,609
Fixed assets	199,333	207,586	Other liabilities	39,889	34,067
Intangible assets	1,009	1,392	Provision for tax, labor and civil risks	10,692	10,647
<b>Total Non-current Assets</b>	<b>200,728</b>	<b>209,326</b>	<b>Total Non-Current Liabilities</b>	<b>59,939</b>	<b>57,323</b>
			<b>EQUITY</b>		
			Stockholders' Equity	284,768	280,163
			Capital reserves	9,382	9,382
			Profit reserves	264	264
			Equity financing	1,409	4,605
			Accumulated losses	(154,867)	(153,164)
			<b>Total Equity</b>	<b>140,956</b>	<b>141,250</b>
<b>TOTAL ASSETS</b>	<b>257,156</b>	<b>262,784</b>	<b>TOTAL LIABILITIES AND EQUITY</b>	<b>257,156</b>	<b>262,784</b>

**INCOME STATEMENTS FOR THE YEARS ENDING**  
*on December 31, 2016 and 2015 (in thousands of Reais)*

	2016	2015
Revenue from Services and Products	77,869	92,133
Economic Subsidy – Government of the State of São Paulo	74,955	61,411
Economic Subsidy – Development	18,740	22,222
Revenue from donated assets – Development	4,888	3,853
<b>GROSS OPERATING REVENUE</b>	<b>176,453</b>	<b>179,618</b>
Taxes on sales and services rendered	(10,606)	(12,695)
Returns and cancellations	(697)	(168)
<b>NET OPERATING REVENUE</b>	<b>165,150</b>	<b>166,755</b>
Cost of services rendered and products sold	(126,325)	(142,386)
<b>GROSS PROFIT</b>	<b>38,825</b>	<b>24,369</b>
<b>OPERATING REVENUES (EXPENSES)</b>		
General and administrative	(29,747)	(31,763)
Fees Administrative Council and Fiscal Council	(1,120)	(1,115)
Third-party services	(7,482)	(8,284)
Depreciation and amortization	(1,707)	(1,768)
Miscellaneous provisions	(945)	(1,793)
Other net operating income (expenses)	1,479	417
	<b>(39,523)</b>	<b>(44,306)</b>
<b>OPERATING INCOME BEFORE REVENUE AND FINANCIAL EXPENSES</b>	<b>(698)</b>	<b>(19,937)</b>
Financial income	2,394	2,860
Financial expenses	(3,401)	(2,516)
<b>INCOME BEFORE INCOME TAX AND SOCIAL CONTRIBUTIONS</b>	<b>(1,704)</b>	<b>(19,593)</b>
Income tax and social contribution	-	-
<b>NET INCOME FOR THE YEAR</b>	<b>(1,704)</b>	<b>(19,593)</b>

**STATEMENTS OF CHANGES IN NET EQUITY**  
**FOR THE YEARS ENDING**  
*on December 31, 2016 and 2015 (in thousands of Reais)*

	Stockholders' Equity	Profit Reserves	Capital Reserves		Resource for Capital Increase	Accumulated losses	TOTAL
			Legal	Tax breaks			
<b>BALANCES ON</b>							
<b>DECEMBER 31, 2013</b>							
	<b>261,658</b>	<b>9,382</b>	<b>0</b>	<b>264</b>	<b>9,901</b>	<b>(125,367)</b>	<b>155,838</b>
Capital increase	9,901	-	-	-	(9,901)	-	0
Resource for Capital Increase	-	-	-	-	8,604	-	8,604
Loss for the year	-	-	-	-	-	(8,204)	(8,204)
<b>BALANCES ON</b>							
<b>DECEMBER 31, 2014</b>							
	<b>271,559</b>	<b>9,382</b>	<b>0</b>	<b>264</b>	<b>8,604</b>	<b>(133,571)</b>	<b>156,238</b>
Capital increase	8,604	-	-	-	(8,604)	-	0
Resource for Capital Increase	-	-	-	-	4,605	-	4,605
Loss for the year	-	-	-	-	-	(19,593)	(19,593)
<b>BALANCES ON</b>							
<b>DECEMBER 31, 2015</b>							
	<b>280,163</b>	<b>9,382</b>	<b>0</b>	<b>264</b>	<b>4,605</b>	<b>(153,164)</b>	<b>141,250</b>
Capital increase	4,605	-	-	-	(4,605)	-	0
Resource for Capital Increase	-	-	-	-	1,409	-	1,409
Loss for the year	-	-	-	-	-	(1,704)	(1,704)
<b>BALANCES ON</b>							
<b>DECEMBER 31, 2016</b>							
	<b>284,768</b>	<b>9,382</b>	<b>0</b>	<b>264</b>	<b>1,409</b>	<b>(154,868)</b>	<b>140,955</b>

**CASH FLOW STATEMENTS FOR THE YEARS ENDING**  
*on December 31, 2016 and 2015 (in thousands of Reais)*

	2016	2015
Income before income tax and social contributions	(1,704)	(19,593)
<b>Adjustments to reconcile net income before income tax and social contributions with net cash generated by operating activities</b>		
Depreciation and amortization	18,920	16,669
Prior periods adjustment	-	-
Creation of a provision for losses on fixed assets	116	-
Residual value of fixed asset depreciation	11	290
<b>Increase (decrease) in operating assets</b>		
Tied financial investments	4,209	13,177
Accounts receivable	(574)	760
Advances to employees and third parties	(2,330)	715
Prepaid and recoverable taxes	228	(1,501)
Inventories	89	29
Services in progress	-	462
Prepaid expenses	(102)	(9)
Compulsory deposits	2	-
Other receivables	(9)	12
<b>Increase (decrease) in operating liabilities</b>		
Suppliers	(1,802)	(835)
Salaries payable and social security tax payable	(396)	(11)
Taxes and contributions payable	3,635	259
Advances from clients	(1,795)	(3,962)
Payables – vacations and social security taxes	1,437	835
Tax installments	155	337
Government subsidies – development agencies	(9,217)	(11,247)
Other liabilities	33	(2)
<b>Net cash used in operating activities</b>	<b>10,906</b>	<b>(3,615)</b>



	2016	2015
<b>CASH FLOW FROM INVESTING ACTIVITIES</b>		
Reduction in long term receivables	(38)	(163)
Acquisition of fixed assets	(637)	(4,625)
Donated assets	(9,709)	(8,031)
Addition of intangible assets	(64)	(503)
Net cash used in investing activities	(10,448)	(13,322)
<b>CASH FLOW FROM FINANCING ACTIVITIES</b>		
Installments	(3,251)	(3,059)
Other liabilities	5,822	8,525
Provision for tax, labor and civil risks	45	47
Endowment for capital increase	1,409	4,605
Net cash used in financing activities	4,025	10,118
<b>INCREASE (DECREASE) IN CASH BALANCE AND CASH EQUIVALENTS</b>	<b>4,483</b>	<b>(6,819)</b>
<b>CASH AND CASH EQUIVALENTS</b>		
At the beginning of the year	4,315	11,134
At the end of the year	8,798	4,315
<b>INCREASE (DECREASE) IN CASH BALANCE AND CASH EQUIVALENTS</b>	<b>4,483</b>	<b>(6,819)</b>

## ***OPINION OF THE FISCAL BOARD ABOUT THE FINANCIAL STATEMENTS***

The Fiscal Board of the Institute for Technological Research of the State of São Paulo S/A – IPT, in the use of its legal and statutory attributions, examined the Management Report, as well as the Balance Sheet and other Financial Statements for the year ending on December 31, 2016, in light of the Report of the Independent Auditors Maciel Auditores S/S, dated February 09, 2017, without reservations, prepared in accordance with auditing standards applicable in Brazil. In view of the checks carried out throughout the fiscal year, the Fiscal Board unanimously considers that these corporate documents adequately reflect, in all relevant respects, the equity and financial situation of the Institute for Technological Research of the State of São Paulo S/A – IPT, which they approve and qualify to be submitted to the appreciation and approval of the company's Shareholders.

São Paulo, February 20, 2017

HILTON FACCHINI  
Fiscal Board Member

LEONARDO MAURÍCIO COLOMBINI LIMA  
Fiscal Board Member

MARILDA ANUNCIÇÃO FERREIRA  
Fiscal Board Member

EDUARDO HENRIQUE DE AZEVEDO  
Fiscal Board Member

## ***INDEPENDENT AUDITOR'S REPORT ON THE ACCOUNTING STATEMENTS***

To the Fiscal Board Members and Managers of the Institute for Technological Research of the State of São Paulo S/A – IPT

### **Opinion**

We have audited the financial statements of the Institute for Technological Research of the State of São Paulo S/A – IPT, which comprise the balance sheet as of December 31, 2016 and the related income statements, changes in net equity and cash flows for the period ending on the aforementioned date, as well as the corresponding explanatory notes, including a summary of the main accounting policies.

In our opinion, the aforementioned financial statements adequately present, in all material respects, the equity and financial position of IPT as of December 31, 2016, the performance of its operations, and its cash flows for the period ending on that date, in accordance with the Brazilian accounting standards.

### **Basis for our opinion**

Our audit was conducted in accordance with Brazilian and international auditing standards. Our responsibilities, in accordance with those standards, are described in the section below, entitled "Auditor's Responsibilities for the Audit of Financial Statements." We are independent in relation to the Entity, in accordance with the relevant ethical principles set forth in the Accountant's Professional Code of Ethics and the professional standards specified by the Federal Accounting Council, and we comply with the other ethical responsibilities set forth in those standards. We believe that the audit evidence we have obtained is sufficient and appropriate to substantiate our opinion.

## Responsibility of management and governance for the financial statements

Management is responsible for the preparation and proper presentation of financial statements in accordance with Brazilian accounting practices, and for the internal controls it has determined as necessary to enable the preparation of financial statements free of material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for evaluating the Entity's ability to continue operating, disclosing, when applicable, matters pertaining to its operational continuity and the use of this accounting basis in the preparation of the financial statements, unless management intends to liquidate the Entity or cease its operations, or has no realistic alternative to prevent its operations from closing.

Those responsible for the Entity's governance are in charge of overseeing the process of preparation of the financial statements.

## Auditor's responsibilities for the audit of the financial statements

Our purpose is to obtain reasonable assurance that the financial statements, taken as a whole, are free of material misstatement, whether caused by fraud or error, and to issue an audit report containing our opinion. Reasonable security is a high level of security, but not a guarantee that the audit conducted in accordance with Brazilian and international auditing standards always detects any possible material misstatements. Misstatements may be due to fraud or error and are considered relevant when, within reason, they can influence, individually or jointly, the economic decisions taken by the users based on the aforementioned financial statements.

As part of the audit conducted in accordance with Brazilian and international auditing standards, we have exercised our professional judgment and maintained our professional skepticism throughout the audit. Moreover:

- We have identified and evaluated the risks of material misstatement in the financial statements, whether caused by fraud or error, planned and performed audit procedures in response to such risks, and obtained audit evidence that is appropriate and sufficient to sub-

stantiate our opinion. The risk of not detecting a material misstatement due to fraud is greater than that arising from error, since fraud may involve the act of circumventing internal controls, collusion, forgery, omission, or intentional misrepresentation.

- We have gained an understanding of the internal controls relevant to the audit to plan audit procedures appropriate for the circumstances, albeit not for the purpose of expressing an opinion about the effectiveness of the Entity's internal controls.

- We have evaluated the suitability of the accounting policies used here and the reasonableness of the accounting estimates and respective disclosures made by management.

- We have concluded that the management's use of the accounting base is suitable for operational continuity, based on the audit evidence obtained. Our findings are based on audit evidence obtained up to the date of our report. However, future events or conditions may prevent the Entity from ensuring operational continuity.

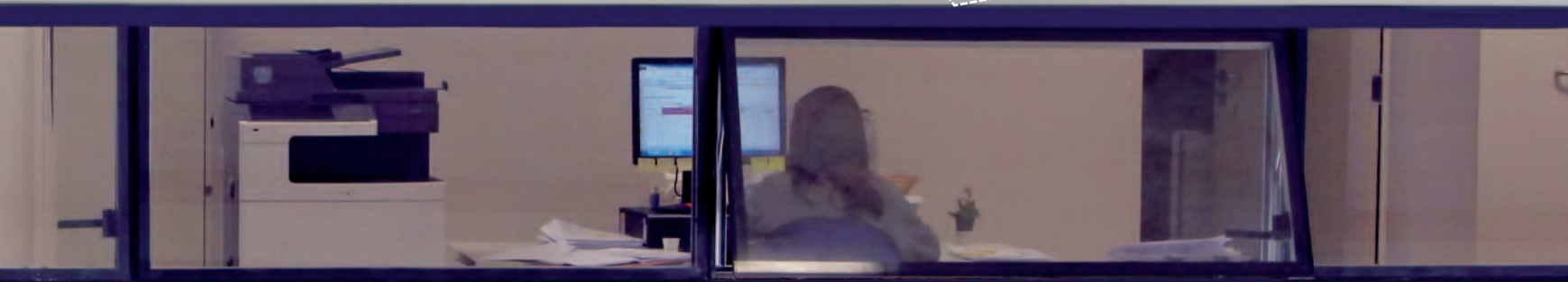
- We have evaluated the overall presentation, structure and content of the financial statements, including disclosures and whether the financial statements represent the corresponding transactions and events in a manner consistent with the objective of adequate presentation.

We have communicated with those responsible for governance regarding, inter alia, the planned scope, timing, and significant findings of the audit, including any possible significant deficiencies in the internal controls that we have identified during our work.

São Paulo, February 9, 2017.

MACIEL AUDITORES S/S  
CRC/RS 5.460/O-0- "S" - SP  
CLAUDIO ROGERIO DE OLIVEIRA  
CRC RS - 52507/O-5 "S" - SP  
Technical Manager







## *Government of the State of São Paulo*

### **Governor**

Geraldo Alckmin

### **Vice Governor**

Márcio Luiz França Gomes

### **Secretary of Economic Development, Science, Technology and Innovation**

Márcio Luiz França Gomes

## *Board of Directors of IPT*

### **Chief Executive Officer – CEO**

Fernando José Gomes Landgraf

### **Chief Financial and Administrative Officer**

Altamiro Francisco da Silva

### **Director of People Systems**

Altamiro Francisco da Silva (interim)

### **Director of Operations**

Mário Boccalini Júnior

### **Director of Innovation and Business**

Zehbour Panossian

## *Administrative Council*

### **President**

Márcio Luiz França Gomes

Cláudio Valverde Santos

Fernando José Gomes Landgraf

João Fernando Gomes de Oliveira

Jorge Abissamra

José Roberto de Sampaio Campos

Maurício Pinto Pereira Juvenal

Ricardo Conrado Mesquita

Ros Mari Zenha

Walter Torre Júnior

## *Guidance Council*

### **President**

Roberto Caiuby Vidigal

### **Vice President**

Pedro Luiz Barreiros Passos

Carlos Américo Pacheco

Carlos Henrique de Brito Cruz

Dan Ioschpe

Fernando de Castro Reinach

João Fernando Gomes de Oliveira

José Luiz Olivério

Mário Sérgio Salerno

Ozires Silva

Rogelio Golfarb

Satoshi Yokota

Tadeu Carneiro

## *Fiscal Board*

Eduardo Henrique de Azevedo

Hilton Facchini

Leonardo Mauricio Colombini Lima

Marilda Anunciação Ferreira

## *Acknowledgements*

We thank all the professionals at IPT whose participation made this edition possible.

## *Sponsorship*

This report was produced and printed with resources from FIPT – the IPT Support Foundation.



fundação de apoio ao  
instituto de pesquisas tecnológicas

## *Annual Report IPT 2016*

### **Planning and Coordination**

Guilherme Mariotto

### **Editorial Coordination**

Arquitetura de Ideias  
Lígia Micas e Rodrigo Prada

### **Texts**

Lígia Micas

### **Review**

Flavio Freitas, Gabriela Romão e João Garcia

### **Graphic Design and Layout**

Hiro Okita

### **Image Editing**

Rita Parise

### **Photographs**

Augusto Colin  
Flavio Freitas  
Guilherme Mariotto  
Mariana Marchesi  
Arquivo IPT



August/2017