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Conference

Internacional Aspects of Defence Policy in Brazil

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Good afternoon!

UNIVERSIDADE FEDERAL FLUMINENSE
INSTITUTO DE ESTUDOS ESTRATÉGICOS

SCIENCE, TECHNOLOGY, AND INNOVATION FOR DEFENSE IN BRAZIL

A Comparative Analysis of Defense Programs and Challenges

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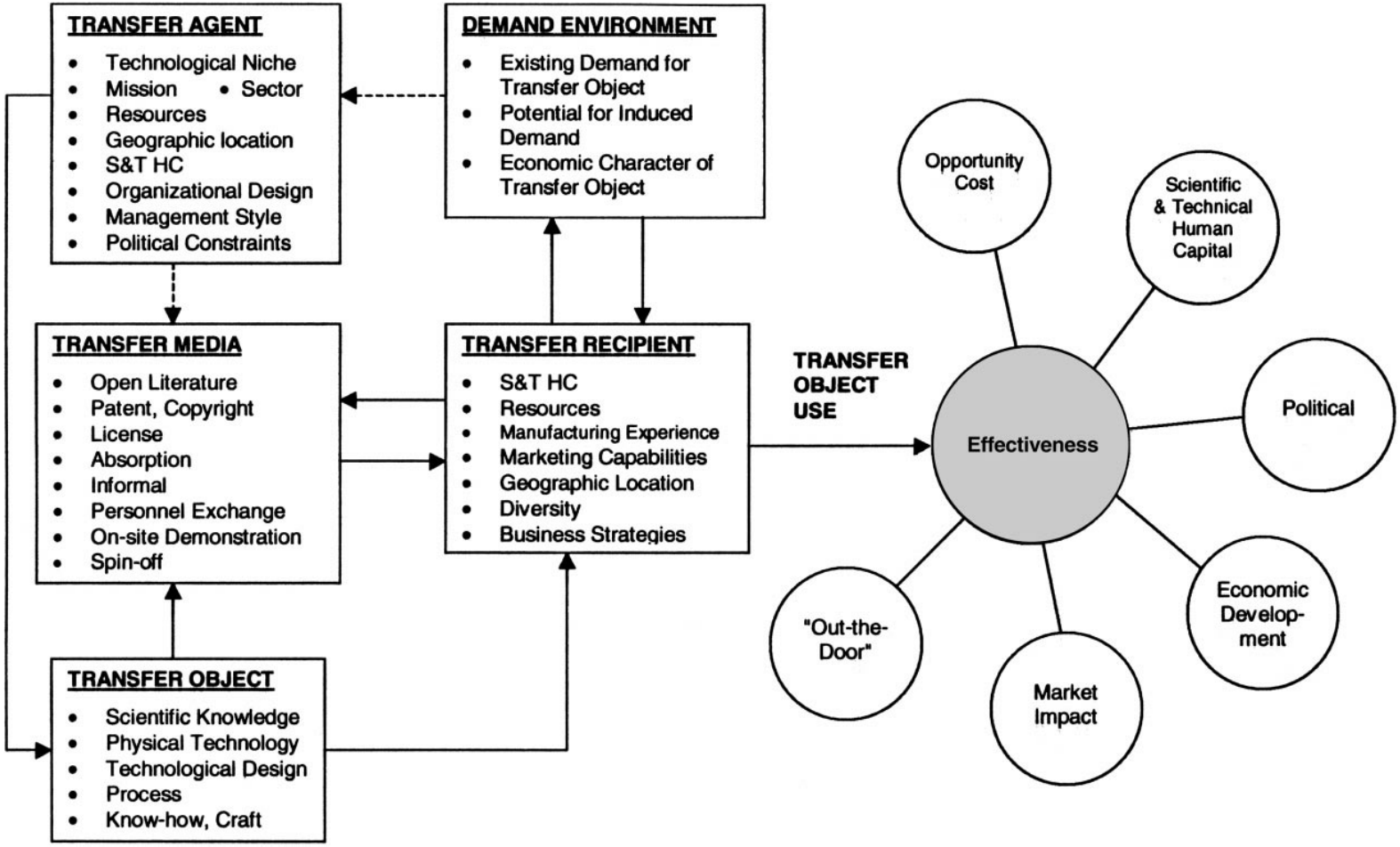
Summary

- Theoretical Foundations
  - Policy Studies, Policy Analysis and Evaluation
  - Evaluating Transfer of Technology – Effectiveness
    - Bozeman Model and Pedone-modified Bozeman Model
  - International Technology Transfers
- Evaluating ToT - Gripen BR Program
- Evaluating ToT – Submarine Development Program (PROSUB)
- Challenges
  - Embraer and Gripen Project
  - "Nationalization of Defense Products" & the question of Brazilian enterprise
  - Crises and the Strategic Projects
- Final Considerations

Bozeman, Technology transfer and public policy: a review of research and theory – *Research Policy* 29 2000. 627–655

Fig. 1. Contingent Effectiveness Model of technology transfer University-Enterprise



Bozeman, Technology transfer and public policy: a review of research and theory – *Research Policy* 29 2000. 627–655

Table 4
Technology transfer effectiveness criteria

Effectiveness criterion	Focus	Relation to research and practice
"Out-the-Door"	Based on the fact that one organization has received the technology provided by another, no consideration of its impact.	Extremely common in practice, uncommon as an evaluation measure (except in studies measuring degree of participation in technology transfer).
Market Impact	Has the transfer resulted in a commercial impact, a product, profit or market share change?	Pervasive in both practice and research.
Economic Development	Similar to Market Impact but gauges effects on a regional or national economy rather than a single firm or industry.	Pervasive in both practice and research.
Political Reward	Based on the expectation of political reward (e.g., increased funding) flowing from participation in technology transfer.	Pervasive in practice, rarely examined in research.
Opportunity Costs	Examines not only alternative uses of resources but also possible impacts on other (than technology transfer) missions of the transfer agent or recipient.	A concern among practitioners, rarely examined except in formal benefit–cost studies.
Scientific and Technical Human Capital	Considers the impacts of technology transfer on the enhanced scientific and technical skills, technically-relevant social capital, and infrastructures (e.g., networks, users groups) supporting scientific and technical work.	A concern among practitioners, rarely examined in research.

Bozeman, Technology transfer and public policy: a review of research and theory – *Research Policy* 29 2000. 627–655

Table 5
Technology transfer effectiveness criteria

Effectiveness criterion	Key question	Theory base	Major advantage and disadvantage
''Out-the-Door''	Was technology transferred?	Atheoretical or classical organization theory	Advantage: Does not hold transfer agent accountable for factors that may be beyond control. Disadvantage: Encourage cynicism and focus on activity rather than outcome.
Market Impact	Did the transferred technology have an impact on the firm's sales or profitability?	Microeconomics of the firm	Advantage: Focuses on a key feature of technology transfer. Disadvantage: Ignores important public sector and non-profit transfer; must accommodate market failure issues.
Economic Development	Did technology transfer efforts lead to regional economic development?	Regional science and public finance theory.	Advantage: Appropriate to public sponsorship, focus on results to taxpayer. Disadvantage: Evaluation almost always requires unrealistic assumptions.
Political	Did the technology agent or recipient benefit politically from participation in technology transfer?	Political exchange theory, bureaucratic politics models	Advantage: Realistic. Disadvantage: Does not yield to systematic evaluation.
Opportunity Cost	What was the impact of technology transfer on alternative uses of the resources?	Political economy, cost–benefit analysis, public choice	Advantage: Takes into account foregone opportunities, especially alternative uses for scientific and technical resources. Disadvantage: Difficult to measure, entails dealing with the ''counterfactual''
Scientific and Technical Human Capital	Did technology transfer activity lead to an increment in capacity to perform and use research?	Social capital theory (sociology, political science), human capital theory (economics)	Advantage: Treats technology transfer and technical activity as an overhead investment. Disadvantage: Not easy to equate inputs and outputs.

Evaluating Transfer of Technology
Pedone-modified Bozeman Model

- Technology itself – "Harware" actually transferred
- Economic Development effects -
  National/regional economy - clusters
- State –Society effects – Fosters democracy, sovereignty, protection of natural resources
- International strategic advantages/disadvantages
  - ToT and geo-political considerations
- Human Capital Scientific & Technological Knowledge Transfer
  - "software" - enhanced skills, training and learning processes

Evaluating Transfer of Technology

Table 1: Three Flows of International Technology Transfers (ToT)

Flow A	Knowledge	Product Design/Specifications
		Materials/Component specifications
		Process designs and blueprints
		Production procedures/schedules and organization
Flow B	Know-How	Production/Organization Know-How
		Operating/managing skills
		Maintenance skills and procedures
Flow C	Know-Why	Process/ production design and engineering Know-Why, skills, procedures and experiences.
Flow C	Know-Why	Product/ market design and engineering data skills
		Project management/ engineering procedures and expertise
		Technology development and research skills, data, procedures etc.

LUCENA SILVA, A. H. and PEDONE, L. (2011) - Adapted from Baark, E. (1997). - Military technology and absorptive capacity in China and India: implications for modernization. In *Military Capacity and the Risk of War: China, India, Pakistan and Iran.* (pp. 84-109). Oxford: Oxford University Press. *Apud* TSAI. Ming-Yen, 2003. *From Adversaries to Partners? Chinese and Russian Military Cooperation after the end of the Cold War*. Greewoog Publishing Group=Praeger. Westport, CT, 2003).

Evaluating Transfer of Technology

- Ultimate criterion for Brazilian increase international stance:

Development of technological and industrial capabilites for autonomous design and production of weapons and defense systems

What is common in Strategic Partnerships Brazil-France/Brazil-Sweden

- Acquisitions with Transfer of Technology
- ToT Management Systems
- Learning Process – first evaluations outcomes / intended outcomes
- A new niche for research and studies – International Relations and Public Policy Analysis and Evaluation – defense projects
- Extension Course at UFF in Policy Evaluation – Evert Vedung (Uppsala Univ), 2013_14_15

Defense Institutional Framework

- Política de Defesa Nacional – National Defense Policy - 1996 (FHC govt.)
- Creation of Ministry of Defense – 1999
- Regulatory Ordinance 764/2002
- Política Nacional de Defesa – National Policy of Defense – 2005 (Lula govt.)
- Estatégia Nacional de Defesa (END)– National Strategy of Defense – 2008. (Decree n. 6703, 18 Dec. 2008)
- Lei Complementar (LCP) n. 136, 25 Aug 2010
- Special Tax for Defense Industry MP 544/2011 – tax incentives
- ➔ turned to Law 12598/2012
- Creation of SEPROD/MD – Secretariat for Defense Products, 2011 – acquisition of defense products and promotion of Science&Techology policies and R&D defense interests)
- Livro Branco da Defesa Nacional - White Book of National Defense (LBDN), 2012
- Estratégia Nacional de Defesa (END) – National Strategy of Defense - Reviewed – 2012
- Individual contracts on Programs

Transfer of Technology Institutional Framework

- Technology Transfer Contract - Instituto Nacional de Propriedade Industrial, INPI – Contrato de Tecnologia
- COMAER — *Política de Compensação Comercial, Industrial e Tecnológica, Diretriz do Comando da Aeronáutica 360-1,* 2005
- Brazilian Navy – *Secretaria da Ciência, Tecnologia e Inovação da Marinha,* - Normas para a proteção da propriedade industrial na MB. SecCTI – 401, 2014. Adopts Law of Industrial Property (LPI) n. 9279/14 May 1996.
- Individual Offset contracts

Two Projects Examined

- Strategic partnership Sweden – Brazil
  - Program Gripen Brazil – FX 2
  - Acquisition of Fighter Jets, ToT production in Br
- Strategic partnership France – Brazil
  - Submarine Development Program (PROSUB)
  - Navy Nuclear Program
  - Construction of 4 SS and 1 SSN in Br and Fr, ToT

Strategic Partnership Brazil-Sweden

reasons for choosing Gripen on FX 2 Program

- Final costs and maintenance costs (circa half of French Rafale), at US$ 130 million (US$ 4,7 billion contract)
- Assurance of delivery of 100% technology transfer solicited by Brazilian Air Force (FAB);
- Assurance of delivery of 100% of technologies asked for by major aeronautics enterprises in Brazil, mainly Embraer;
- Transfer process – “On Job Training”, design/project engineering learning process

Joint Development and Transfer of Technology

FX-2: reequipamento e modernização da Força Aérea Brasileira foi iniciado em 2006, após uma mudança profunda no projeto inicial FX. O Programa Gripen NG BR prevê gastos da ordem de US$ 2,2 a US$ 3 bilhões, exigindo a transferência completa de tecnologia, e mais recentemente passou a incluir o direito de produção sob licença da aeronave no Brasil e de exportação para o mercado sul-americano.

	GRIPEN NG	RAFALE-C	F-18 E/F
Fabricante	Saab	Dassault Aviation	Boeing Company
País	Suécia	França	Estados Unidos
Comprimento	14,1 metros	15,27 metros	18,31 metros
Altura	4,5 metros	5,34 metros	4,88 metros
Envergadura	8,4 metros	10,80 metros	13,62 metros
Peso máximo	18,7 toneladas	24,5 toneladas	29,9 toneladas
Motorização	1 Volvo RM-12	2 Snecma M-88	2 GE-F 414/400
Velocidade	2.130 km/hora	2.390 Km/hora	2.160 Km/hora
Alcance	4.000 Km(vazio)	1.852 Km	2,346 Km
Armamento	1 canhão de 27 mm, mais 6 t de bombas e mísseis	1 canhão Giat 30mm, mais 6 t de bombas e mísseis	1 canhão 20 mm, mais 8 t de bombas e mísseis

INFOGRÁFICO/AE

Technology "Hardware"

- ToT – industrial cooperation SAAB-Embraer
- 66 Offset contracts
- Akær – fuselage, wings, door landing gear
- ATECH (subsidiary Embraer) – IT, Command&Control systems, ToT mgt, new technologies mgt.
- MECTRON – Air-air Darter missile systems to Gripen
- AEL – displays, software, computer technologies avionics
- SBTA – S. Bernardo Tecnologia Aeroespaciais – SAAB-Inbra Filtros investment – front fuselage, rear wings

Economic Development National/Regional

- Formation of clusters of airspace companies
- Future investment planned – BRL $ 10 billion
- More than 60 offset contracts in negotiations

State-Society

defense modernization & democratic dimension

- Modernization on a democratic context – different from last military industrial-technological efforts, 1970-1980.
- National Objective of Defense (PND, 2005)
  - Sovereignty, national assets, territorial integrity
- Democratic values in international relations:
  - non-intervention
  - Defense of peace, peacuful resolution of conflicts
  - Democracy

International Political Strategic partnership – Sweden- Brazil

- Sweden – European Union – 1995 – downloaded defense security policies
  - Crisis management
  - Merges with European defense firms– technological innovation =key
- New geopolitical realities Century 21
  - Ressurgence of Russia
  - China
- Increased protection of Brazilian-Swedish interests
  - Swedish Industrial center – 250 Swedish companies in Brazil
  - Amazon, Blue Amazon, South Atlantic
- Partnership can contribute for International peace and security – Middle East – Mediterranean Sea, Caribbean

Human Capital Science & Technology

"software" transfer

- 357 Brazilian aeronautics and defense industry engineers to develop Gripen NG in Linköping
  - Formation -- *On Job Training*
  - *Specialization*
- 21 military specialists from DCTA –Dept of Airspace Science and Technology/COMAER
  - Supervision and evaluation between 2015 and 2021
  - Development, testing, certification
  - Final production

Strategic Partnership Brazil- France

- Strategic Agreement 2005 - Cooperation in High Technology
- Cooperation Armed Forces , 2007
- Joint Declaration Strategic Partnership Lula - Sarkozy , 2008 .
- Air Forces, Navy of France and Brazil
  - HX -Br Development Airbus helicopters
  - PROSUB - DCNS France / Brazilian Navy

Brazilian Navy – Blue Amazon

Brazilian Navy Strategic Programs

MARINHA DO BRASIL

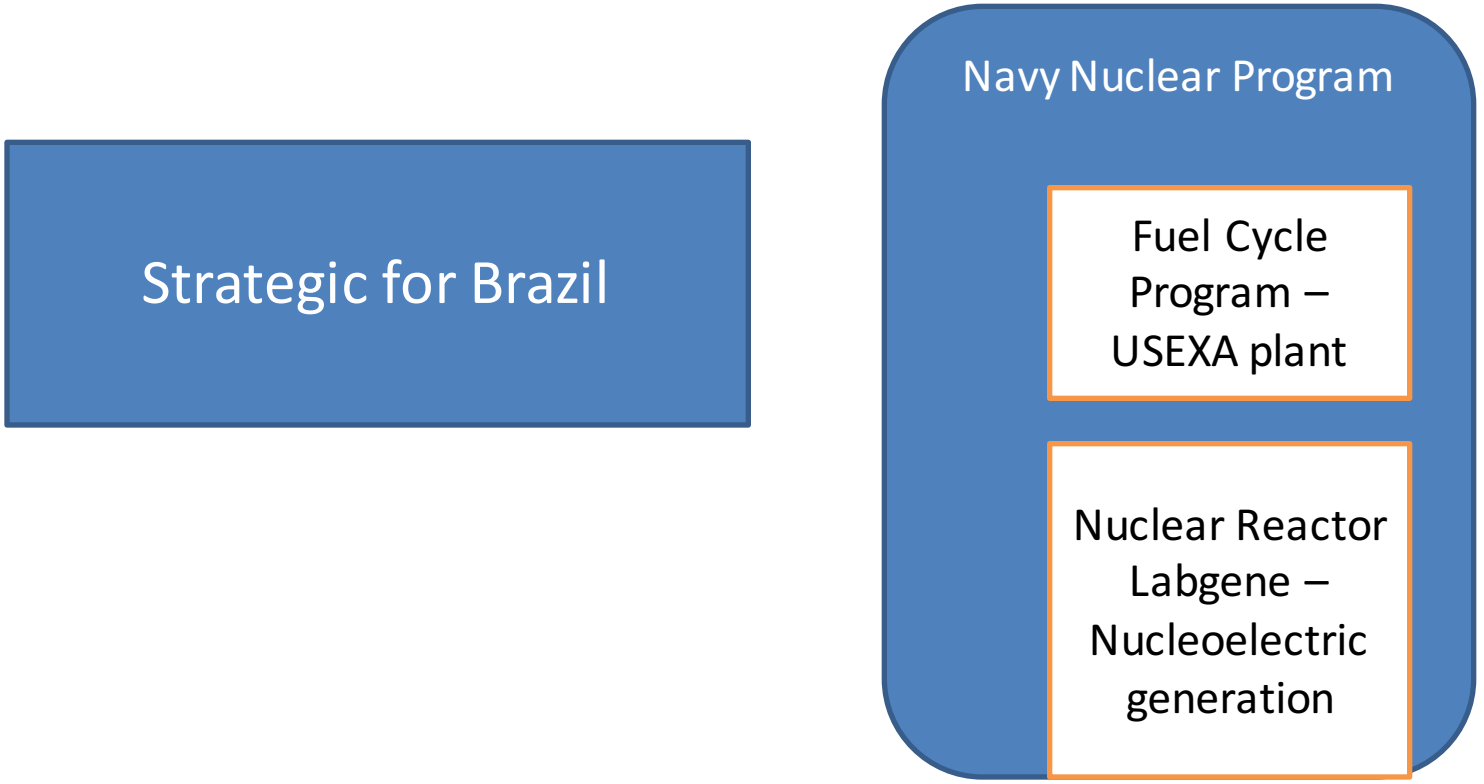
PROGRAMAS ESTRATÉGICOS DA MARINHA

Projetos	Período previsto	Valor Global Estimado até 2031 (em R$ milhões)
1. Programa Nuclear da Marinha (PNM)	1979 - 2031	4.199,00
2. Construção do Núcleo do Poder Naval	2009 - 2047	175.225,50
3. Recuperação da Capacidade Operacional	2009 - 2025	5.372,30
4. Sistema de Gerenciamento da Amazônia Azul (SisGAAz)	2013 - 2024	12.095,60
5. Complexo Naval da 2a Esquadra / 2a Força de Fuzileiros da Esquadra (2a FFE)	2013 - 2031	9.141,50
6. Segurança da Navegação	2012 - 2031	632,80
7. Pessoal	2010 - 2031	5.015,60

Senado Federal - CCT / 2013

Navy Nuclear Program

- Turning point – 2007 – US$ 2.57 bi – restart



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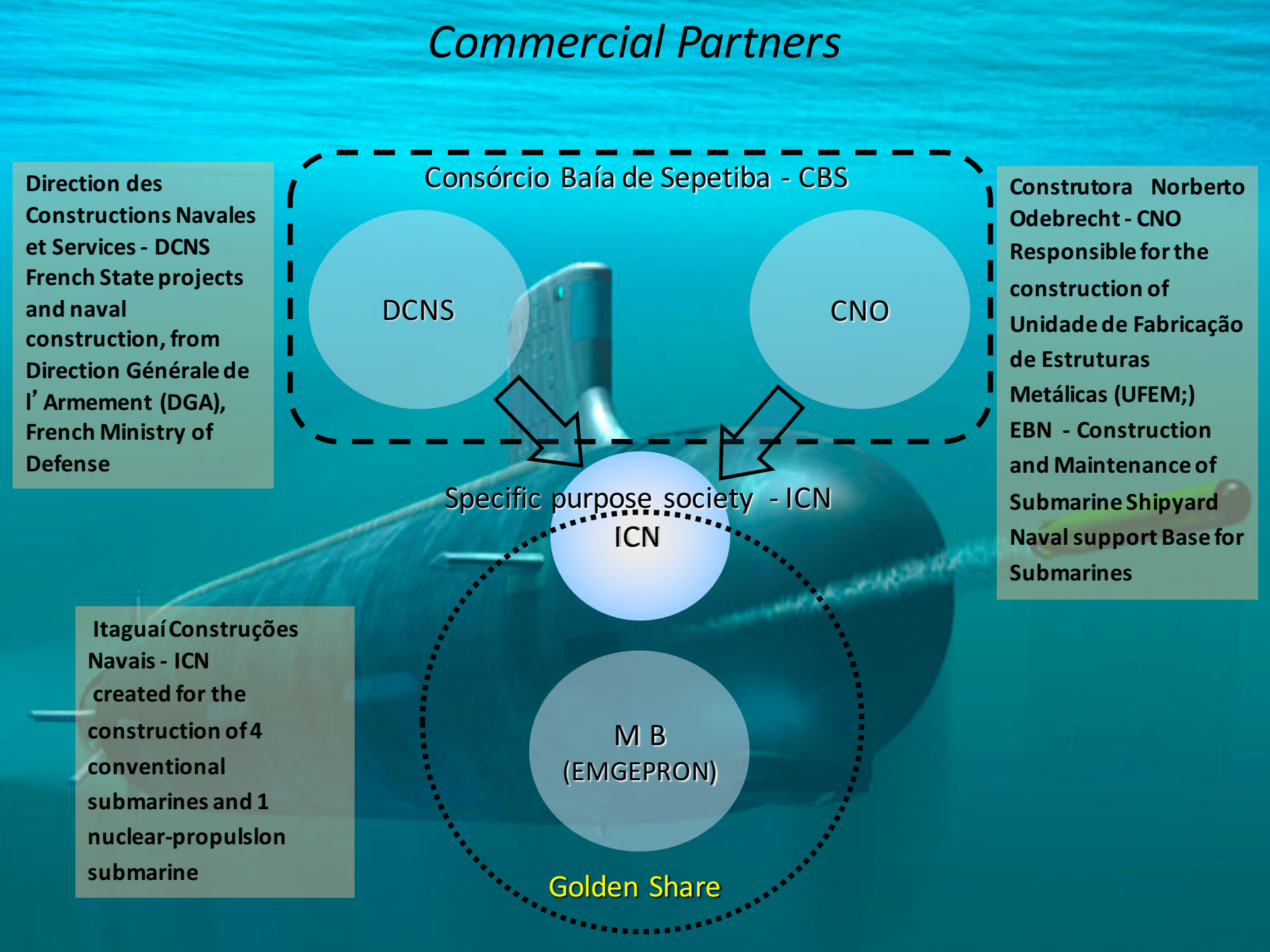
Trade agreements on PROSUB - Development and Transfer of Technology

Rodrigo Azeredo
Pedro Fonseca Junior

Commercial Partners



Direction des Constructions Navales et Services - DCNS
French State projects and naval construction, from Direction Générale de l'Armement (DGA), French Ministry of Defense

Construtora Norberto Odebrecht - CNO
Responsible for the construction of Unidade de Fabricação de Estruturas Metálicas (UFEM;)
EBN - Construction and Maintenance of Submarine Shipyard
Naval support Base for Submarines

Itaguaí Construções Navais - ICN
created for the construction of 4 conventional submarines and 1 nuclear-propulslon submarine

COMMERCIAL CONTRACTS
MODULAR ENTREPRISES OF COGESN

SBR

Contrato 6.1
ToT de Construção

Contrato 1 A
Material

Contrato 3
Torpedos

Contrato 1 B
Construção SBR

Contrato 8
Offsets (parte)

UFEM / EBN

Contrato 6.3
ToT de Instalações

Contrato 4
UFEM, Estaleiro e Base Naval

SN-BR

Contrato 6.2
ToT de Projeto

Marinha do Brasil

Contrato 2 B
Construção SN-BR

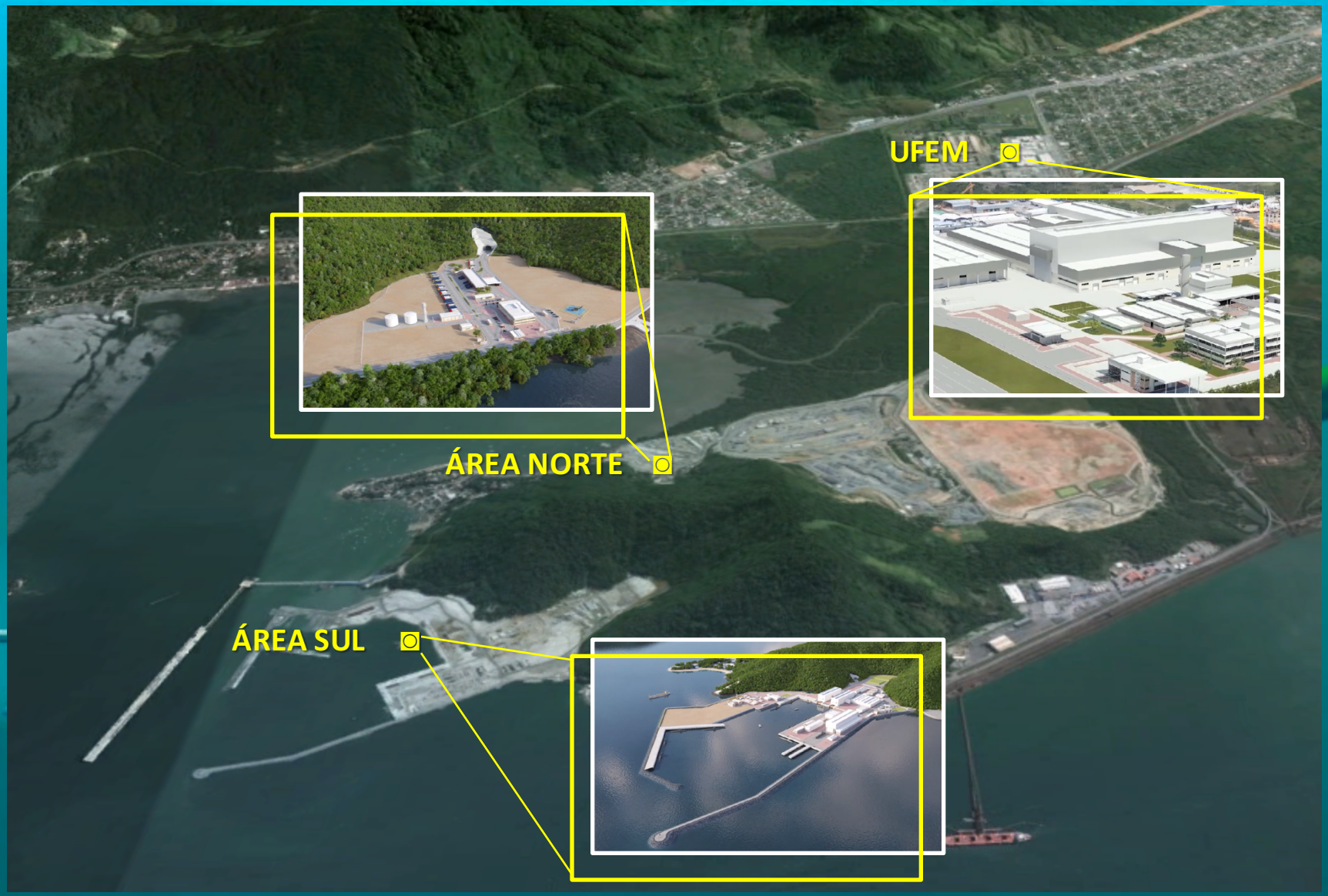
Contrato 2 A
Material

Contrato 8
Offsets (parte)

Contrato 5 – Administração, Planejamento e Coordenação do Objeto Precípuo COGESN – Gen Coordination Development Program of the Nuclear Propulsion Submarine - Brazilian Navy

INDUSTRIAL INFRASTRUCTURE

UFEM – SHIPYARD – NAVAL BASE (EBN)



CONTRACT 6 OFFSET

OFFSET
OFFSET 7 – Criação da Sociedade de Propósito Específico (SPE)
OFFSET 8 – Treinamento de EMC/EMI
OFFSET 1 – Taxa de Licença Relacionada à Construção dos 4 (quatro) S-BR
OFFSET 2 – Taxa de Licença Relacionada à Construção da Base Naval e do Estaleiro
OFFSET 3 – Programa de Nacionalização do S-BR e do SN-BR
OFFSET 4 – Projeto Detalhado da Seção Intermediária do SB-R
OFFSET 5 – Capacitação em Engenharia de Apoio Logístico dos Submarinos
OFFSET 6 – Projeto do SN-BR
OFFSET 9 – Treinamento de Manutenção do Sistema de Combate
OFFSET 10 – Engenharia do Sistema de Combate, Integração, Manutenção e Apoio
OFFSET 11 – Treinamento de Manutenção do Sonar
OFFSET 12 – Treinamento de Manutenção do IPMS
OFFSET 15 – Raia Acústica Móvel
OFFSET 16 – Assistência Técnica para o NAe São Paulo
OFFSET 17 – Apoio a Estudos de Hidrodinâmica
OFFSET 18 – Análise do Projeto do Módulo de Propulsão do SN-BR Desenvolvido pela MB
OFFSET 19 – AMRJ Modernização
OFFSET 20 – IPMS Desenvolvimento, Integração, Manutenção e Apoio
OFFSET 21 – Projeto Preliminar de Laboratório
OFFSET 13 – Treinamento do Quadro Elétrico Principal
OFFSET 14 – Treinamento de Manutenção do Motor Elétrico da Propulsão

CONCLUÍDOS
2 Offsets

EM EXECUÇÃO
17 Offset

NÃO INICIADOS
2 Offsets

Technology "Hardware"
Transfer of Technology

- Contract 6.3 - Nationalization Plan
- UFEM – 254 groups of civil engineering projects; 83 specifications documents
- EBN – 175 groups civil engineering projects; 83 specifications documents – equipment specifications
- Furnished by DCNS

Technology "Hardware" 2

- ToT – industrial & naval cooperation DCNS-Brazilian Navy and Consortium of Companies on Itaguai-Rio de Janeiro cluster
- 21 Offset and ToT contracts
- 104 subsystems projects - 56 priority "Nationalization"
- 200 Brazilian firms visited – potential suppliers to subsystems
- Project/Construction of Nuclear Propelled Submarine
  - material package
  - computer technologies avionics
  - Construction of Nuclear Plant (exclusive Brazilian technology)
  - logistic system
  - Project management

PROJECT & CONSTRUCTION PROGRAM
CONVENTIONAL SUBMARINES

S40

Seção de Vante (seções 3 e 4) - construídas na França, foram transferidas para o interior da UFEM nos dias 31MAI e 01JUN2013, sendo conduzida, no momento, a fase de pré-acabamento pela ICN.

Seção de Ré (seções 1 e 2) - em construção na NUCLEP; término em NOV2014.

Término da construção e lançamento do S-BR1 – JUL2017.

S41

teve início em 04/09/2013, no galpão auxiliar da Nuclebrás Equipamentos Pesados S/A (NUCLEP)

S40 Riachuelo 2/2018

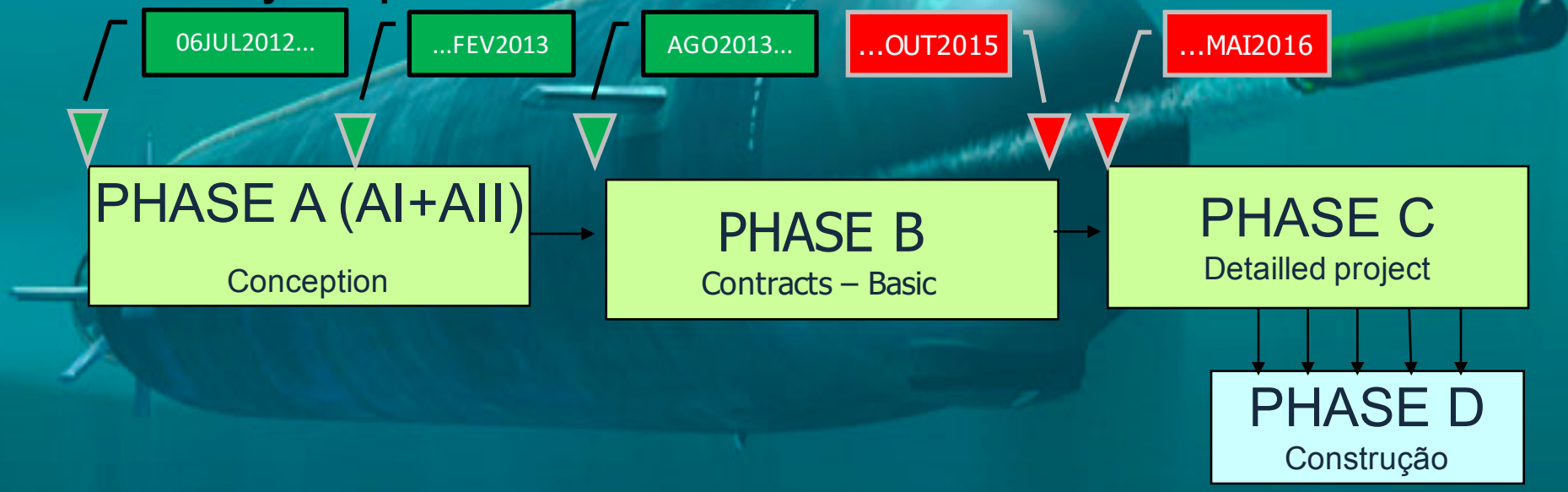
S41 Humaitá 1/2020

S42 Tonelero 2/2021

S43 Angostura 1/2022

DESIGN & CONSTRUCTION PROGRAM
SN10 Álvaro Alberto Nuclear Propulsion

- ✓ "Conception Phase" concluded July / 13
- ✓ "Preliminary Phase" iniciated August / 13
- ✓ "Construction Phase" will start in 2017, Shipyard on the Complex EBN (Estaleiro e Base Naval)
- ✓ Getting ready– 2023
- ✓ Delivery for operation - 2025



Economic Development National/Regional

- Formation of clusters of naval suppliers companies
  - Itaguai
  - Rio de Janeiro – Niterói
- Total investment planned – BRL $ 32 billion

Economic Development National/Regional 2

PROSUB PROGRAM	DIRECT EMPLOYMENT	INDIRECT EMPLOYMENT
Construction of EBN/UFEM	8,000	32,000
Construction of S-BR	2,000	8,000
Project SN-BR + Navy Nuclear Program	2,150	n.a.
Construction of SN-BR	1,500	6,000

From: Fleet Admiral Hirschfeld presentation to the Commission of Foreign Relations and National Defense. Chamber of Deputies (6 August 2014).

State-Society and International Strategy
defense modernization & democratic dimension

- Fundamental achievement Navy Nuclear Program
  - "...design, construction and putting into operation on-board nuclear reactor and...[all] equipment and facilities...concerned with operational safety".
- Authonomous uranium enrichment program
- Independent foreign policy – robust defense policy (Amorim, 2013)
- Geo-political dimension – dissuasion capabilities
  - South Atlantic, Blue Amazon
- Industrial capacity potential – sustainability question

State-Society and International Strategy
defense modernization & democratic dimension

- South Atlantic and NATO countries
  - Challenges for diplomacy and defense
  - China and Africa countries
  - Guinea Gulf piracy
  - Brazilian Military Cooperation with African Countries

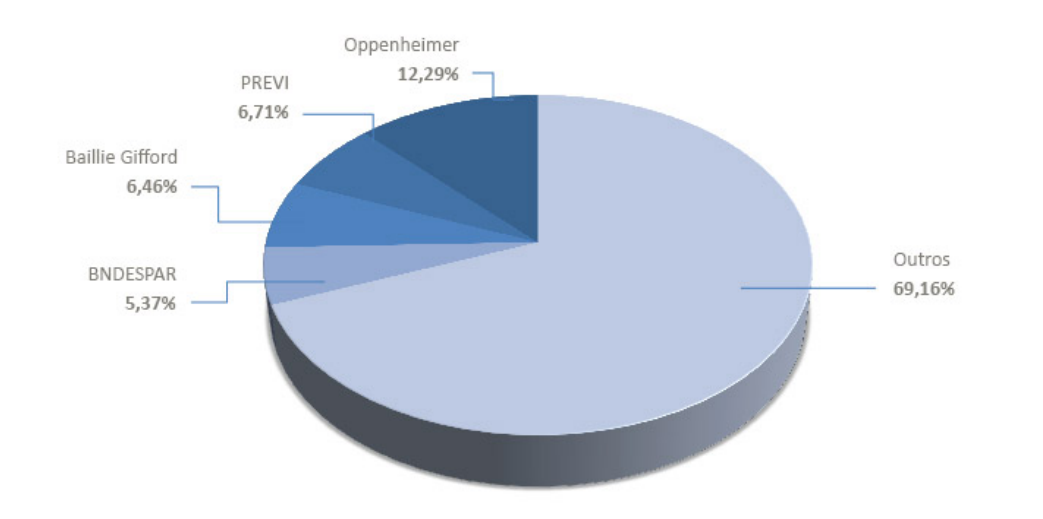
- Increased protection of Brazilian interests and fostering responsibilities
  - Pre-Salt – 15 billion barrels proven reserves
  - US$ 1 billion daily trade on South Atlantic maritime routes

Human Capital Science & Technology

"software" transfer

- Past Navy experience in Tot Corvettes, Frigattes, Submarines
  - Formation -- *On Job Training*
  - *Recycling*
- 31 Navy officers/Engineers
  - Project technology – Technical Assistance
  - Review of German technical norms Tupi sub construction
  - *On Job Training DCNS,* industry, nuclear subs
  - Exercise complete viability project for 1700 ton sub
  - Tech docs e blueprints for a 3000 ton conventional sub
  - Nuclear /non-nuclear interface
- DCNS 25 experienced engineers to train in Brazil
- 18 Navy Engineering officers
  - Logistics support

Challenges



Embraer ownership, 2014
Golden share 0,3%

Challenges

Table 3 A – Embraer Equity Distribution, 2014 (%)

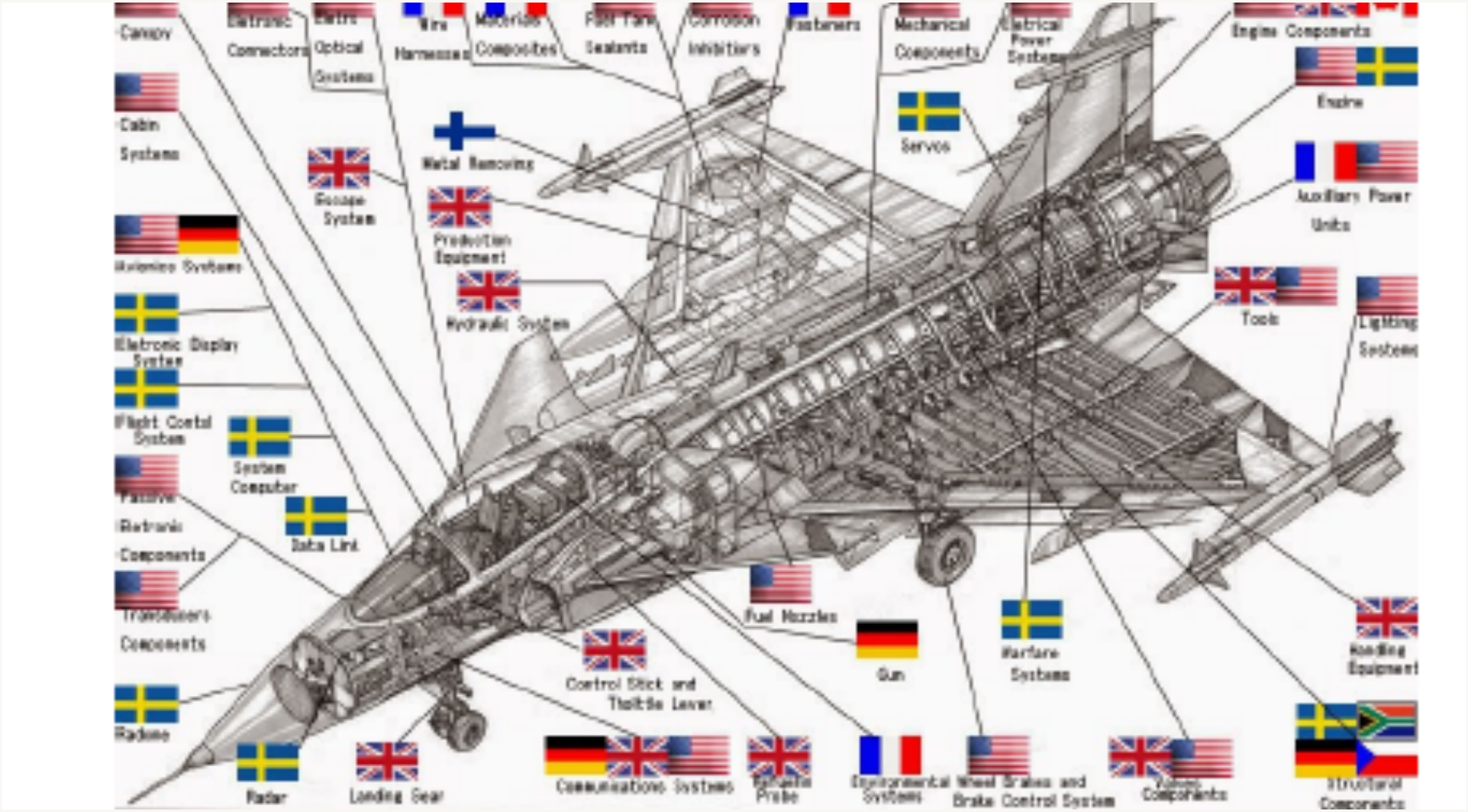
Government of Brazil Golden share	0.3
BNDES PAR	5.37
Previ - Bank of Brazil Pension Fund	6.71
Oppenheimer Funds INC	12.29
Baillie Gilford & Co.	6.46
Total	30.83
Other investors include: Bozano Group Sistel Pension Fund (Telecommunication Brandes Investment Partners, LP Barrow Hanley, MeWhinney& Strauss LLC, Acadian Asset Mgt LLC , Thornburg	69.16
Public Stock Trade Bovespa - SP	48
Public Stock Trade NYSE	52

Sources: Embraer reports

Embraer

- Public enterprise until 1990s
- Technological leap with AMX – A1 subsonic fighter R&D with Italy, 1980s
- > 240 supplied to Italian/Brazilian Air Forces
- Evolution to Civilian regional aviation planes
- Military training / missions Supertucano
- KC390 Medium size Military Cargo
- New technological leap??? Expected 5th generation fighter Gripen Br NG

Challenges: Gripen subsystems by country of origin



Challenges

- "Nationalization" and the question of Brazilian enterprise
- Brazilian enterprise
  - Headquarters and industrial plant
- Strategic Defense Enterprise
  - Minimum of 1/3 of voting capital of Brazilian shareholders – voice national interests protection

Challenges

- Low priority given to ST&I for defense except for few sectors
- 3 Crises – Economic - Political – Corruption (major Brazilian companies involved also in Defense projects)
- Delays Budgets Cuts
- Lay off of 1,500 workers at Itaguai works
- Uncertain Budgetary future - next 3 years

Final Considerations

- Defense ST&I has only recently received support from politicians and budgetary allocations.
- Lack of a defense career = Public Policy Specialist and Program Manager instituted in 1989- public exam entrance
- Except military Research Centers, priority is low. This gets worse on account of feeble support for defense on the part of society, as recent surveys done by IPEA show. Declining military expenditures Budget cuts
- Ambitious programs – difficult to implement successfully over long run
- Lack of commitment to defense issues on the part of the elites

Final Considerations

- Private sector adherence to Defense project in view of tax and financial incentives
- Increase military spending without correspondent expansion of DIB
- Lack of sustained procurement
- No reduction of dependence on international military purchases
- No reduction in international restrictions and technology blockages
- Lack of a sustained ST&I development as whole and for defense in particular
- Lack of a long term national project
  - few sectors have that clear, for example, the military
  - Politicians, high level bureaucrats, industrial and financial elites have yet to make a clear, long term commitment. **The country resents it !**

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Thank you!

Luiz Pedone