

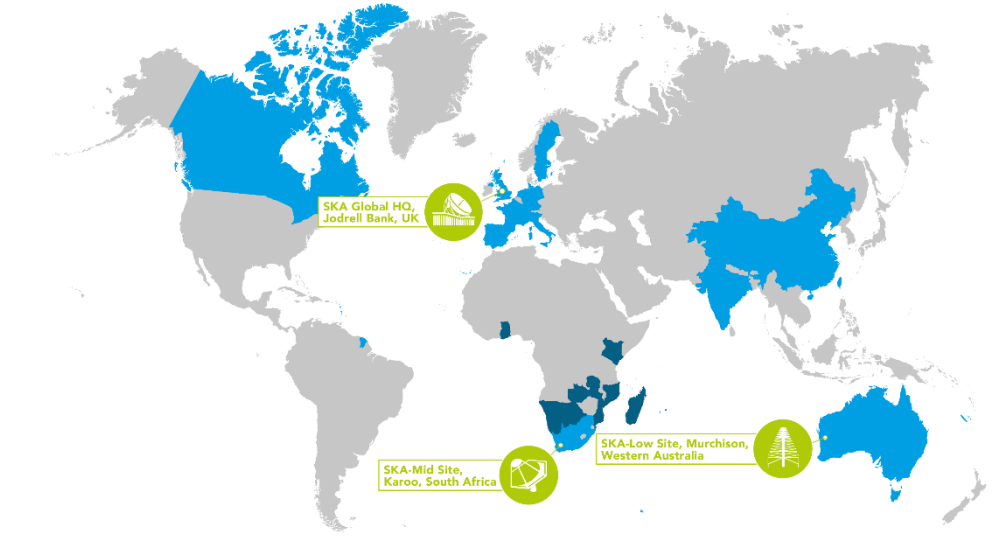
Innovation through the SKAO

The story of the MSF



Gabriel Marquette

SKA, the science project of all superlatives



SKA Partners – includes Members of the SKA Organisation, precursor to the SKAO –, current SKAO Member States*, and SKAO Observers (as of January 2022)



African Partner Countries



- SKA
 - The world's largest radio telescope
 - A 2 B€ project (CAPEX + 10y OPEX)
 - A global project: 16 SKAO Member States and Observers + 8 African Partners Countries
 - 100 organisations across about 20 countries
- The biggest ever-built scientific machine
 - Beyond scientific goals ever reached
 - Request for mandatory technology breakthroughs to reach the objectives



France in the SKA project



• Pros

- France = big astronomy player
- Complementarity with other instruments (both optical and radio)
- Pathfinders in France (Nenufar/Lofar)

• Cons

- Limited resources for new Large Research Infrastructures
- Competition with other astro projects
- Other scientific priorities

France in the SKA project: no choice !

- Unique solution : INNOVATION !
 1. Technology: machines needed do not exist (exascale computer, H2 energy systems,...)
 2. Business model : Big Science business
 3. Project culture : management by objective
- How ?
 1. Astrophysics/astronomy = science (dragging force) + technology (means)
 2. Systemic approach : scientists, industry, PA = 3 partners equally interested and rewarded
 3. SKA = lighthouse for :
 - research (scientific objectives)
 - industry (business perspective)
 - PA (social/societal achievements)
 4. Focus on well-identified targets where France can play a leading role
 5. Proof by action: convince by demonstrating, run in front of competition.

Change of paradigm

- **Situation analysis :**
 1. Sequential approach will take too long
 2. Lack of means (HR and finance)
 3. Need to build a new system, aggressive (positive way) to bring results and to demonstrate the absolute necessity to be in SKA and take our « market share » in science, business and societal ROI.
- **Empowerment of all stakeholders :**
 1. Involvement of PA since the beginning in the progress of research projects
 2. Making scientists working in multidisciplinary teams
 3. Making researchers from academia and industry partnering in mixed teams
- **Interest/added value:**
 1. For industry, big science has always been attractive: technology progress, innovation, new metiers, new business, new business model (industrial rules, IP management, procurement rules)
 2. For PA, a means to find where and how to bring support (political and financial) and spend wisely public money
 3. For scientists, a guarantee to keep their independence and freedom to lead their research.

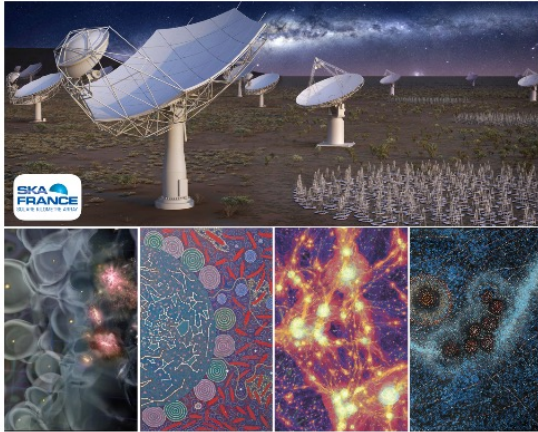
Parallel action plan (2016-2018)

- In France :
 1. Motivate and structure the scientific community towards SKA objectives
 2. Gather together scientists and technologists to identify the crucial technology gaps and define a common roadmap to answer SKA demand
 3. Introduce SKA to all PA offices concerned: research, foreign affairs, finance, etc.
 4. Prepare for the Large Research Infrastructure Roadmap
- With SKA Office :
 1. Reinforce French scientists representation in science WG
 2. Introduce French industry on targeted subjects
 3. Ensure permanent representation at Board level and scientific and technical WG
- Achievements :
 1. The French SKA White Book
 2. Industry/Science Workshops on Energy, HPC, HF feeds, etc.

The French SKA White Book

French SKA White Book

The French community towards the Square Kilometre Array



Editor in Chief:

C. Ferrari

Editors:

G. Lagache, J.-M. Martin, B. Semelin — Cosmology and Extra-galactic astronomy
 M. Alves, K. Ferrière, M.-A. Miville-Deschenes, L. Montier — Galactic Astronomy
 E. Joselin, N. Vilmer, P. Zarka — Planets, Sun, Stars and Civilizations
 S. Corbel, S. Vergani — Transient Universe
 S. Lambert, G. Theureau — Fundamental Physics
 S. Bosse, A. Ferrari, S. Gauffre — Technological Developments
 G. Marquette — Industrial Perspectives and Solutions

176 authors from

* 40 French research institutes



* 6 private companies



Industrial perspectives and solutions



Scientific and technology workshops:

- Energy
- Energy and Cryogeny
- HPC/Big Data
- Signal processing
- System integration (AIV, ITF)

French companies involvement:

- Rfl Energy for SKA RSA: Engie
- French industry meets with SKAO: Airbus, Callisto, Air Liquide, Bull Atos, Thalès, Kalray, Fedd, CNIM, Bertin

THALES

AIRBUS SAFRAN
LAUNCHERS

IBM

FABRICANT DE CARTES
ET PRODUITS
ELECTRONIQUES PROFESSIONNELS

ENGIE NOKIA

Callisto

KALRAY

Alcatel-Lucent

ST life augmented

DDN STORAGE

Schneider Electric

AEG

EDF

TOTAL

SBFT

NVIDIA

intel

BULL

AIR LIQUIDE Alcatel-Lucent

ENIM

AIRBUS

Air Liquide
creative oxygen

bertin
TECHNOLOGIES

SKA FRANCE
SQUARE KILOMETRE ARRAY

SKA France factsheet in 2017



French contribution to the SKA:

- Observer at SKA Board and Strategy Committee
- Chair of AENEAS GA & 1/3 Members of Ext. Adv. Board
- Invitees to all SKA scientific and technological conferences
- 55 scientific experts in SWG (including 2 co-chair)
- French ILO in SKA Industry Liaison Group and member of PSOW
- Contributor to SKA tech. consortia: LFAA, MFAA, WSBF, DISH, SDP

French SKA community:

- 176 contributors to the French White Book
- > 250 scientists involved today, 400 by the end of 2017
- > 40 French labs involved
- > 50 experts from the industry
- 6 LE, 3 SMEs involved in RfI & collaborative projects for SKA

SKA France actions in 2 years:

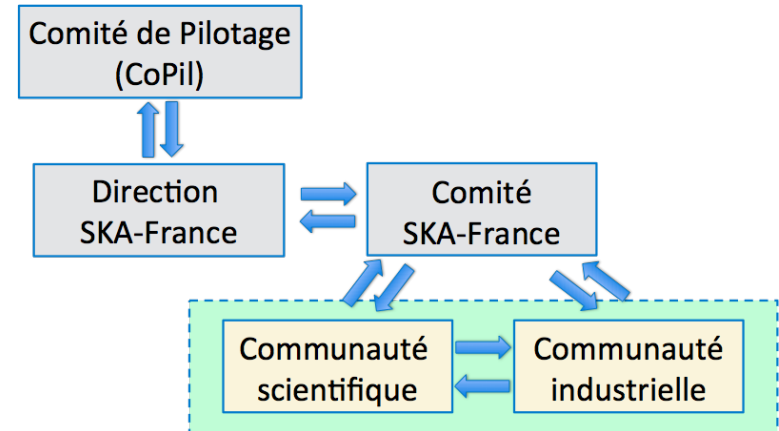
- 2 French industry days (> 50 organisations)
- 2 presentations to HC TGIR
- SKA France visits at SKA Office
- SKAO visits in French companies
- 10 scientific and technology workshops: SP, Energy, HPC/Big data

→ Ready to move forward to the next step :
« Maison SKA France »

Maison SKA France



- * A 3y MoU, strong real equilibrated PPP, between research organisations and their industry partners
- * A science and technology roadmap
- * A forum to develop fundamental research and R&D projects
- * A precursor of a new business model for Large Research Infrastructures



Maison SKA France



Objective: make France joining SKAO

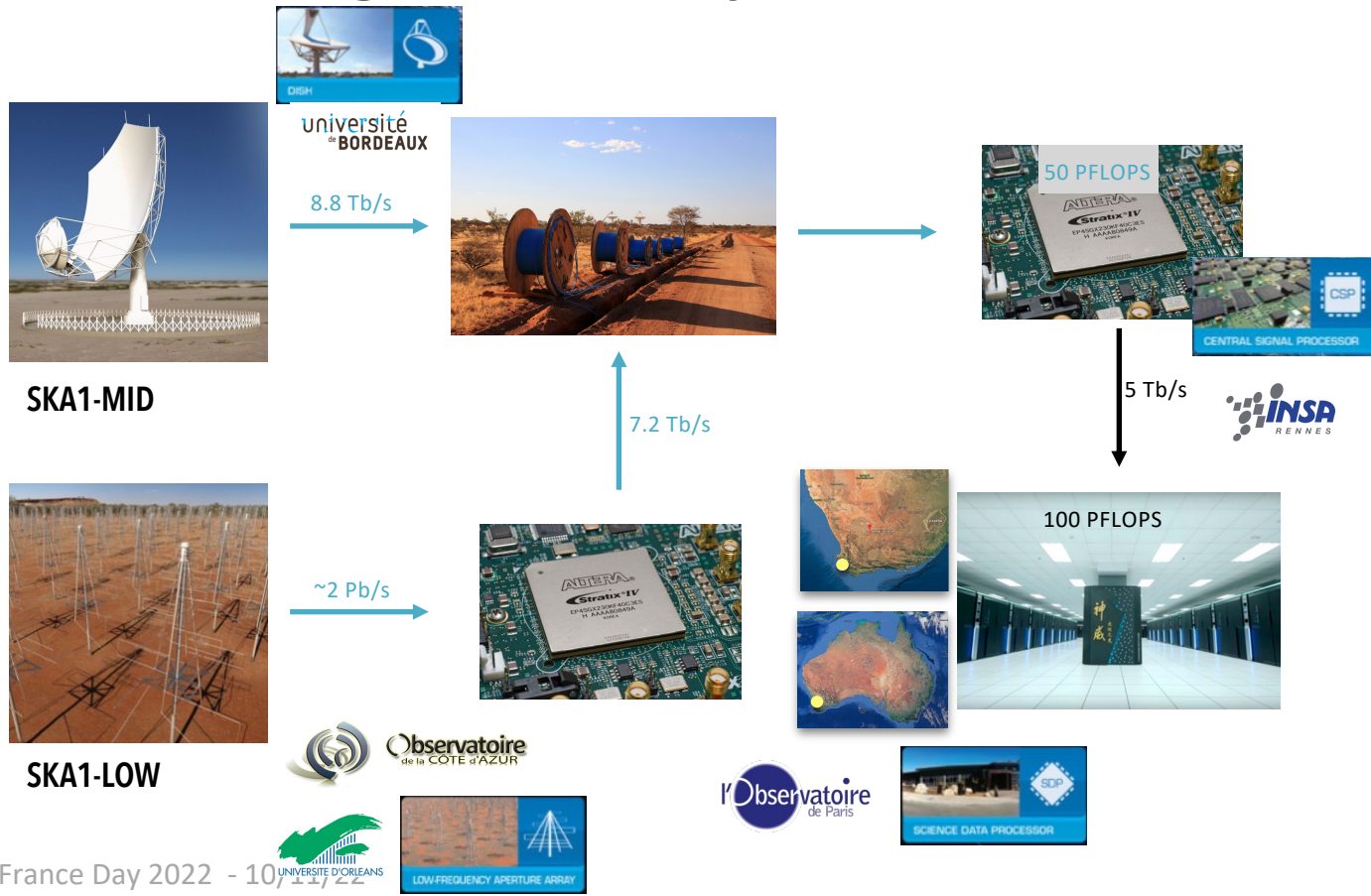
- A common vision
- An adaptive strategy
- Short & mid-term goals clearly defined
- HR and financial means engaged
- MoU opened to new partners

MSF : the « couteau suisse » tool

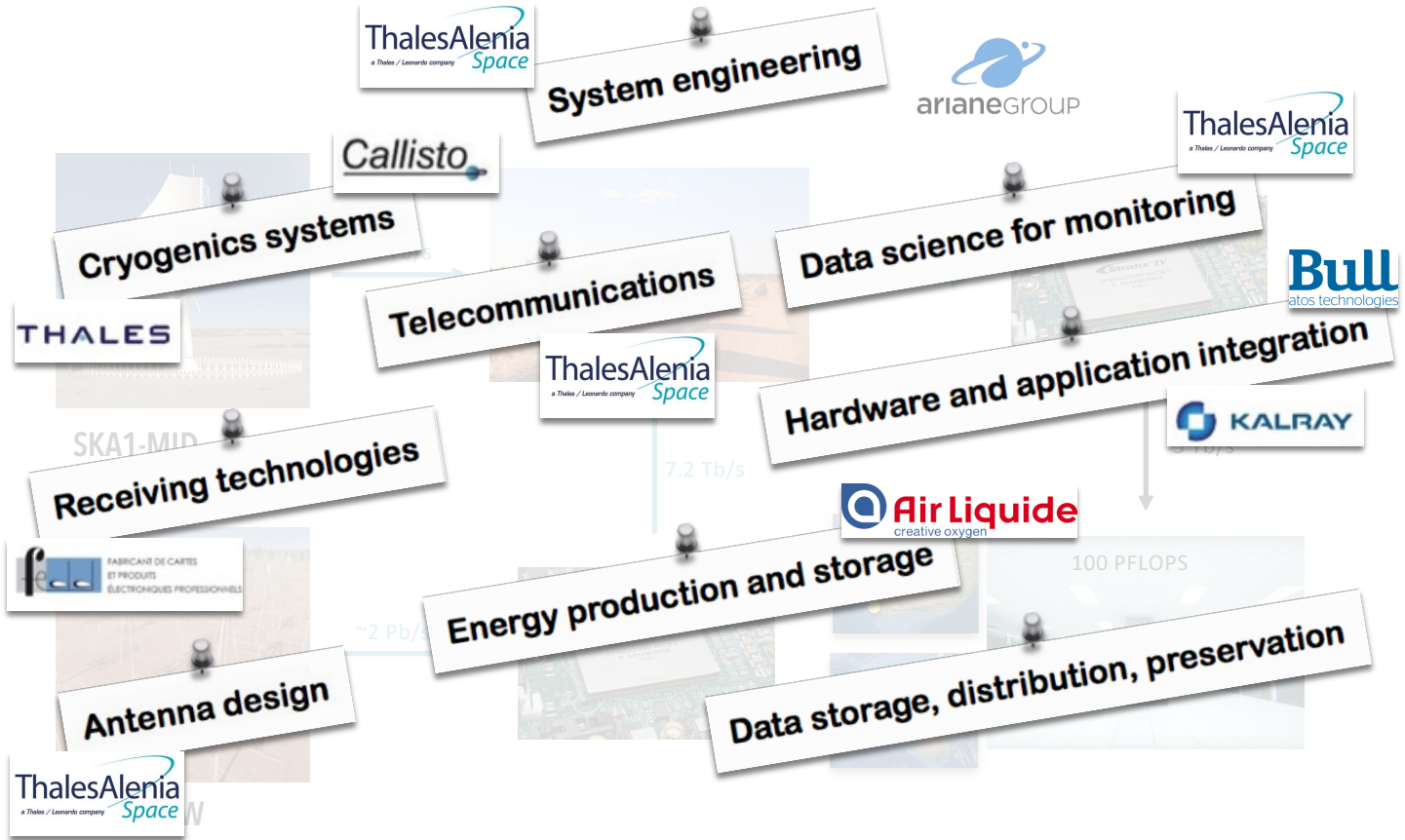
- Interface with SKA Office, to prepare for the future position of France
- Interface with French PA to permanently show the reality of SKA in France and its growing dimension
- Host for all research institutes to invite scientists of all necessary domains (Astro, Big Data, Energy...) starting from France (CNRS, CEA, INRIA, Obs,...)
- Host for all new comers from industry






Building this fantastic machine: technological developments in France



Industrial perspectives and solutions



Industry contributions: baseline & innovations

Description	Acteurs	Ligne budgétaire	Lot de construction
Centres de calcul scientifique SPC (supercalculateurs HPC) Offre intégrée, optimisée globalement Codesign HW/SW 	Atos BULL	• Lots de construction	Mid/Low SPC
Récepteur de la bande 5 de SKA-Mid	FEDD - Lab	• Lots de construction	Mid digitization
Antennes hydrogène SKA-Mid (Refroidissement des détecteurs par hydrogène liquide et alimentation électrique des antennes) 	CNIM Air Liquide	• Lots de construction • Opérations	DISH
Approvisionnement en énergie - Centrale photovoltaïque, système de stockage (éventuellement production / distribution d'hydrogène liquide pour SKA1-Mid) 	IPP français Equipementiers français (Air Liquide)	• Opérations	

Maximisation du retour vers les industriels français en allant chercher des revenus sur les deux lignes budgétaires:

- Capital cost of construction (lots de construction)
- Coûts opérationnels

Certaines de ces innovations (antenne hydrogène) ne peuvent être acceptées que démonstration faite (niveau de TRL atteint permettant de déclencher une « Engineering Change Proposal »)

Maison SKA France



And finally it happened !

From:

- 2016: SKA France Coordination
- 2018 :
 - Maison SKA France
 - SKA on French LRI Roadmap
 - CNRS member of SKAO
- 2019 : SKA in INSU/AA prospective
- 2021 : France's accession to the SKA Observatory

To:

- 2022 : signature of the accession agreement with the SKAO

Closing of the MSF, long life to SKA France 2.0 !

- End of the 3y MoU
- Mission accomplished.



Thank you !



Gabriel Marquette
grbmarquette@gmail.com