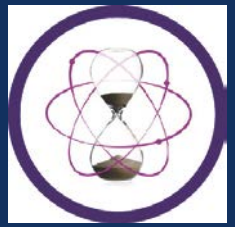
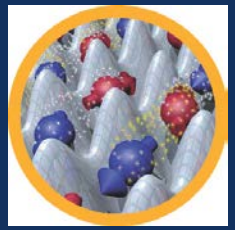
Quantum Technologies






Netherlands activities in
Preparation of FET Flagship
Freeke Heijman / Servaas Duterloo NL
Board of Funders meeting Brussels, 30 June 2016

nl
2016

National Icon: QuTech (Delft)

2013: Minister launched Delft Advanced Research Center

Ambition

- From quantum **science** to quantum **engineering**
- Building a regional ecosystem for Europe

Achievements

- 8 ERC grantees hosted in QuTech
- ERC Synergy grant
- Microsoft Partnership, Intel Partnership

Recent outcome

- National partnership € 250 mln.
- Amsterdam EU Presidency Conference

- ✓ All Quantum experts within 3 hours driving distance
- ✓ Over 300 fte in quantum related research
- ✓ Est. € 250 mln. QuTech base funding over 10 yrs (PPP)
- ✓ Est. € 350 mln. additional grants over 10 yrs (European and national)

Source: FOM

Primary roadmaps

1. Fault-tolerant computing
   - Semiconducting qubits
   - Superconducting qubits
   - System Architecture
2. Topological Quantum Computing
3. Quantum Internet
   - Loop-hole free bell test
   - Quantum repeater
4. Cross disciplinary
   - Software, algorithms, electronics, theory, materials

Top People involved



Lieven Vandersypen

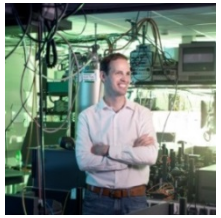
Leo DiCarlo

Koen Bertels



Leo Kouwenhoven

Carlo Beenakker (Leiden)




Erik Bakkers (Eindhoven)

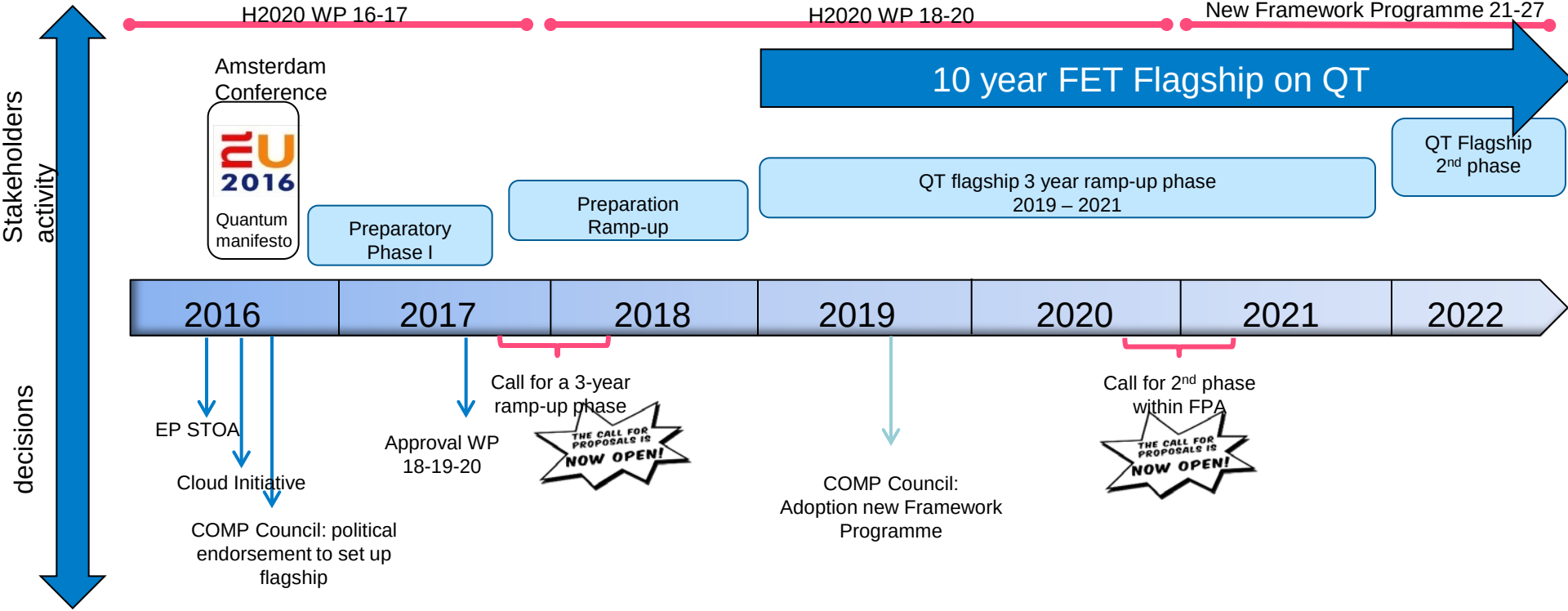
Ronald Hanson

Tim Taminiau


Stephanie Wehner

Harry Buhrmann (Amsterdam)

CONFIDENTIAL



FPA: Framework Partnership Agreement

Timeline

- 17-18 May: Launch Manifesto in Amsterdam
- 26-27 May: COMP Council Conclusions
- June: BoF meeting, July: appointment HLSC
- November 2016: Deliverables by HLSC
- June 2016 –June 2017: preparatory phase flagship

Features of Flagship preparatory process

- High Level steering Committee appointed by Commission
- **Offer to BoF:** Netherlands' liaison between BoF and HLSC
- Supportive leadership of proactive member states
- European set-up encompassing all actors
- MS involvement via Flagship Board of Funders and QUANTERA
- Serving and involving science, industry and policy communities
- Appropriate consultation of scientific and industrial stakeholders
- Reporting to EC and directly to High-level group on Competition and Growth
- Deliverables HLSC: Strategic Research Agenda, Implementation, Governance

"No more science as usual"…
"…Timing is essential in this endeavour as our competitors do not wait. Outside Europe a number of industrially driven initiatives have emerged, for instance in the area of *quantum computing*".
Gunther Oettinger, *17th May 2016*
https://ec.europa.eu/commission/2014-2019/oettinger/announcements/speech-quantum-technologies-conference-amsterdam-17-may-2016_en

"Do we have a chance of beating the Soviets by a rocket to land on the moon, or by a rocket to go to the moon and back with a man? "

"I believe this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth"

JFK, *25th May 1961*

http://history.nasa.gov/monograph37.pdf

Features of a Flagship

- No more science as usual, moon-shot approach
- Involving broad expertise from academia, national labs, industry – not only physicists but also electrical engineers, computer science, material science
- Set a unifying goal: e.g. Quantum Computer, Q- Internet, Q- Repeater, Q- Simulator
- Short term applications to be generated through other H2020 instruments – perhaps in Partnering Projects
- Making a difference for the researchers involved

H2020/FET Framework conditions

Mission of a flagship is a given

Long-term, large scale research initiative aiming to solve ambitious S&T challenges. From science to technology to economic value….

Implementation model can be reinvented (fit for purpose)

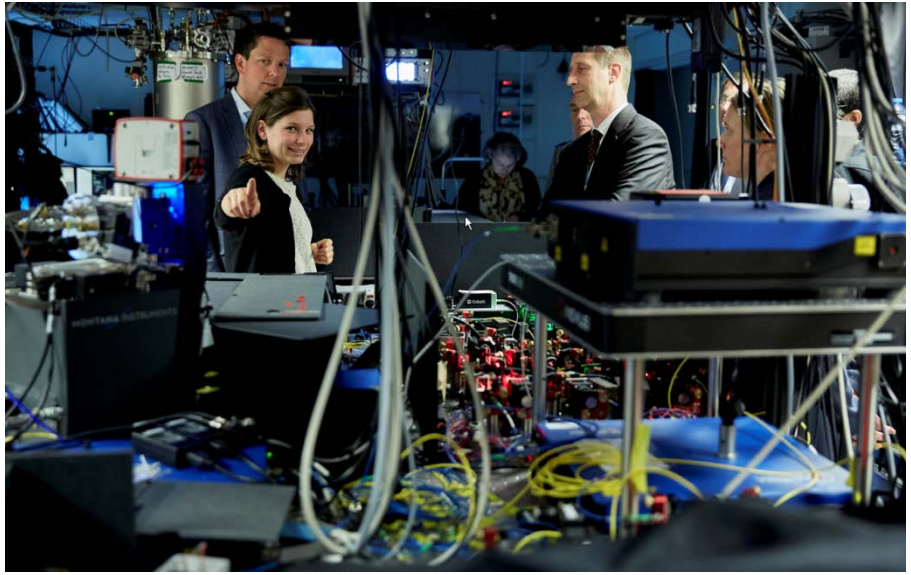
priorities *across H2020 (LEIT, FET) and across EU*

business as usual (1 gets all) to

"daring"*: mission driven with goals that can be evaluated, competition, involve complementary expertise…*

Strategic Research agenda

Oettinger: I expect the most high risk – high gain part of the agenda to be at the core of the flagship effort which should be taken-up by our risk taking Future and Emerging Technology programme. Other chapters with shorter time to market like communication and sensing may be better served by more industry oriented funding schemes.



A “postcard” from Amsterdam

Annex – food for thought

SWOT Analysis Flagship instrument

Strengths Size of consortia Possibility to get and to keep European Quantum research communities engaged Output and impact orientation Possibility of an enduring effort Possibility of larger than national Member State scale funding Prestige and acknowledgement	**Weaknesses** Bureaucratic Lengthy and complex procedures Swiftness to adapt to changes Impossibility to discard obsolete research results or activities Risks of administrative issues with large number of partners
Opportunities Competitive bidding for R&D cooperation by industry and European Union Option of long term programming Creating “a face” towards US and Asian research programmes Demonstrate good and sound governance of European cooperation between scientists and industry Leveraging additional national and private funding	**Threats** Breakdown of functioning due to other items on the EU Research agenda Conflicts within the flagship structures Relation with the board of funders Conflicts over funding, IP over complexity Conflicting IP and funding interests between Core projects and partnering projects Politics in Commission / Member states Companies to shy away if results disappoint Slowdown of advanced groups by slower ones

Strategy

High risk – high gain part of the agenda to be at the core of the flagship effort which should be taken-up by our risk taking Future and Emerging Technology programme.

Other chapters with shorter time to market like communication and sensing may be better served by more industry oriented funding schemes.

…

Implementation model

Lessons learned

- Fit for purpose
- No scattering of funding
- Structure follows strategy
- No guts no glory

An invitation to be inspired by

- ASML story
- ERC synergy grants (reintroduced by 2018?)
- IARPA, e.g. CSQ, CSQ, LogiQ, MQCO
- NASA e.g. project organisation for Apollo programme
- ESA, e.g. MeliSSA project

Governance model

Role of the EU

- Funding of CP, supporting the genesis, ensure delivery

Role of EU MS / national governments

- Funders for PP, (first?) Users
- Regulation, proliferation

Role of universities, RTOs

- Provide the backbone for research, researchers, cooperation and facilities
- Research, education, valorisation (IP, tech transfer)
- Facilitation / interface with researchers and funders

Role of Industry/SMEs

- Funding, market take up, adding value