



Canales 2020 Project From participation to "enganching"

Enrolling, Motivation, Technical Aspects and Challenges





Ancients tales says...

- There is something beyond courses and university ...
- Another way to learn..., Another way to teach...
 - Collaborative, task oriented, no boundaries,
 just people working together →
 knowledge without frontiers
- BUILD SYSTEMS THAT WORK

 \rightarrow that is the goal





• Students, professors, graduates, ...

WHY SHOULD I PARTICIPATE?





Maybe is better to stay out

It would stole your time, drain your energy and who knows what else ...





But I like the robotics and computer eng.! \rightarrow this is key motivation





Enrolling Canales 2020 But I look for a different way of learning, teaching, collaborate!

You are an unconscious, or a crazy!





If you are still here ...

Perhaps there are some excuses that sounds reasonable





Motivation

- XXI century world is very competitive
- The University degree is good but you need more to emerge between the crowd
- Society, academia and industry need:
 - Critical thinking
 - Team players & leadership
 - Practical knowledge, Self-learning
 - –Enthusiastic, brave, unconscious! → ready to face new problems...





Motivation

- The Canales 2020 Project can be a powerful source for:
 - <u>Dissemination</u> of ATC research&teaching activities
 - <u>Recruiting</u> major of Computer Engineering students
- Space-like programs are a good source of challenges for this.
 - Highly inspiring both for students and faculty
 - Broad range of challenges: structures, materials, electronics, sensors/actuators, communications...
 - A variety of applications: aerial (UAVs), rovers, underwater, ...





- Credits \rightarrow Is It possible?
- Bachelor and master projects("PFCs"): specific project topics
- Curriculum → experience <u>VERY</u> relevant for companies
- Networking → contacts on the industry, research centers, freelances
- Practices on companies supporting the project





- News
- Department certificates
- International competitions → awards
- Courses "extra" scores: up to 30% of the final qualification of a subject can be obtained from participation on the project activities. Implementation is "professor/course" dependant → under study





- Related courses "extra" scores →
- 1º-2º years → most of them are possible but which ones is under discussion
 - Tecnología y Organización de Computadores
 - Estructura de computadores
 - Arquitectura de computadores
 - Ingeniería de servidores
 - ...





- Related courses "extra" scores →
- 3º-year → computer engineering path
 - Desarrollo de Hardware Digital
 - Sistemas con Microprocesadores
 - Arquitectura de Sistemas
 - Arquitecturas y Computación de Altas Prestaciones
 - Diseño de Sistemas Electrónicos
 - ; ?





Related courses "extra" scores

4º year → computer engineering path

- Tecnologías de Red
- Centros de Procesamiento de Datos
- Sistemas empotrados

Optional courses

- Tecnologías emergentes, Implementación de algoritmos en hardware
- Informática industrial, Controladores lógicos programables
- Circuitos integrados e impresos, Mantenimiento de equipos informáticos





Extrinsic professor motivation

- Credits → looking for the way "department compensation ?"
- Teaching innovation projects → periodic?
- Project management/participation → Is possible to qualify the project as a scientific or industry one? Maybe at "local level"
- Networking → contacts on the industry, research centers, freelances
- News, international competitions (awards), ...
- Early enrolling of best students → PhDs





Technical Aspects

- The **idea**:
 - To build an "Apollo"-like program providing missions and projects for students
 - The program could span for several years, with shorter missions/projects
 - Follow the way big organizations work (NASA, ESA,...)
 - Mission planning, documentation, simulation and tests, etc.





Inspiration

• The **big ones**...





And also small ones:











CubeSat





Proposal of Programs

 Canales 2020 (ok, we'll look for a better name)

Flying carrier + rover to explore an "asteroid"

StratoGlider

 Stratospheric probe with controlled return of payload

Neptune

- Exploration of underwater environments

• Open to new ideas...





Canales 2020

- Internal name, motivated by
 - The place simulating our asteroid
 - A tentative deadline for the complete mission
- Maybe better names for the program
 - ATLAS
 - Ulysses







Destination







Our asteroid







The rock

• "Peñón de Canales" (or "Púlpito de Canales")







The rock







Quite hard to get there...







Big steps

- 1) Develop a vehicle to perform a photographic fly-by
 - Objective: build a 3D map to study candidate landing sites and routes for the rover
- 2) Develop a **flying vehicle** to safely and accurately drop a rover (how?)
- 3) Develop a **rover** able to move in a really steep surface, with vegetation, rocks, climbs,... and cliffs
- 4) Advanced mission: flying vehicle able to pick-up the rover and returning it safely to home.





Flying vehicles

- UAVs probably based on quad-copters
- Challenges:
 - Autonomy (battery)
 - Accuracy (vision-based + GPS ?)
 - Able to carry payload (the rover)
- Initially, launched from near the rock
- Bonus extra: launching from the ETSIIT (in this case, a blimp seems more adequate)





The rover

- Due to difficult terrain, maybe **better legged** than wheeled locomotion.
- Challenges:
 - Locomotion
 - Autonomy (solar cells?): seek maximum survivability
 - Atmospheric conditions (snow, lo-hi temps, ...)
 - Scientific instruments: temp, cameras, other?





Other programs

- "StratoGlider"
- Even high-school students are launching stratospheric balloons (> 30 Km)











Stratoglider

- Going further: try to make the **payload return to us**
- Lifting body: no engines, controlled fall plane (GPS + Aillerons)











Neptune

- Underwater robotics
 - Can be tested in reservoirs close to us (Canales, Cubillas)
 - Autonomy??









In the long term...

Satellites

- Pico-satellites:
 - CubeSat
 - WikiSat (UPC)





• Google Lunar X-prize (who knows...)







Aspects to be considered

- Experiments (scientific payload and instruments)
- Vehicle design (flyby, lander, rover...)
- Telecommunications
- On-board systems (electronics, termal control...)
- Navigation
- Flight operations design: launch-encounterlanding-return





Now:

We are on Pre-Phase A:

- Preliminary analysis
- proof of concept specifying:
 - what to build
 - when to launch
 - when and how the spacecraft will reach the target
 - and what operations will be carried out.
 - build-versus-buy decisions
 - what spacecraft instruments are needed
 - where system tests will be performed
 - who performs mission operations
 - what ground data system capabilities (Ground segment, Mission control center)

Full Mission Life Cycle







Next steps:

- Who is with us?
- Getting deeper on Mission inception and design
 - Source: NASA's "Basics of Space Flight".





Conclusions

- There are some "reasonable" excuses to participate on this project
- Perhaps you get credits or "extra score" but the really important facts are:
 - Enjoy
 - Work with partners
 - Learn

....

• And finally ... **ENGANCHING**



A reflection

MIT

Technology

Review

Computer
 Engineering is
 more than
 Facebook...

HAS QUANTUM HC COMPUTING TC FINALLY ST ARRIVED? BE Upfront p24 Bu

HOW TOMORROW'S STARTUPS WILL BE FUNDED Business Report p75

TECH TRANSFORMS MUSIC, ART, AND PROSE Reviews p87

Buzz Aldrin, Apollo 11 moonwalker, would like a word with you

You Promised Me Mars Colonies. Instead, I Got Facebook.

We've stopped solving big problems. Meet the technologists who refuse to give up. p26





Want to join us?







Thank you...

And welcome!

