

SPACE 4.0



esa grand challenge

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SPACE 1.0: Astronomy





SPACE 2.0: Race in Space



Lunochod

A detailed view of the International Space Station (ISS) in space, showing its complex structure with multiple modules, truss segments, and large solar panel arrays extending outwards.

SPACE 3.0: Steps for global cooperation and space applications

Shift of paradigms!

- change of motivations
- change of actors
- change of contents
- change of roles
- change of technologies

→ **SPACE 4.0**



SPACE 4.0:

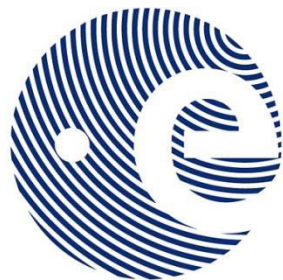
- Commercialisation
- Participation
- Information
- Innovation
- Interaction
- Inspiration
- Cooperation
- Jobs & growth
- Digitalisation

society

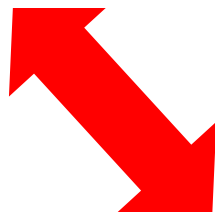
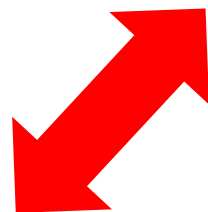
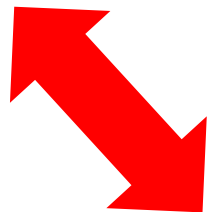
politics



SPACE 4.0



esa



science

industry



SPACE 4.0

Interaction:

- Member States
- Academia
- Industry
- Citizens
- Staff
- Partners worldwide



SPACE 4.0: SPIN-IN-OUT



SPIN-TOGETHER

“The use of new, or existing, ideas, discoveries and inventions “

Spin-IN

“...in the **space sector**,
stemming **from other**
sectors”

Spin-TOGETHER

“Innovation also consists of **scientific, technological, organisational, financial and commercial steps**, which are intended to, or actually lead to the implementation of **innovation** by space-non-space partnerships

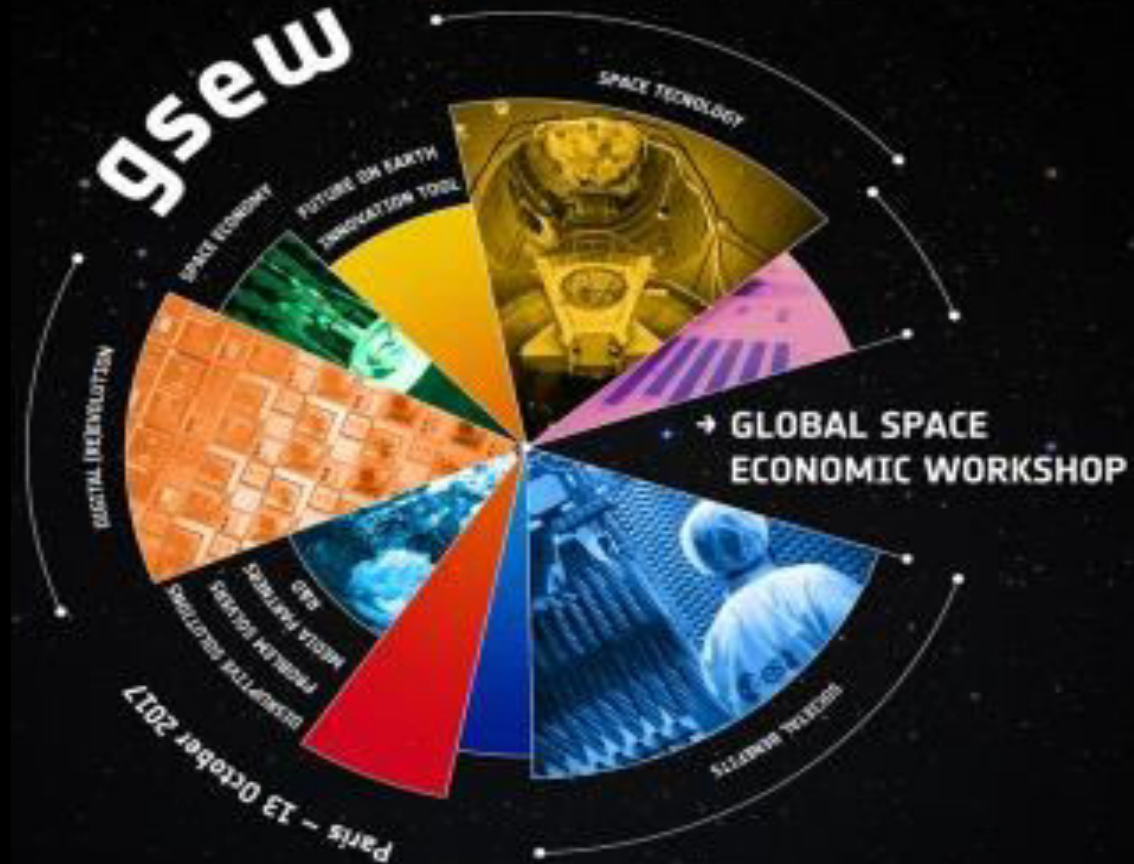
Spin-OUT

“...in **other sectors**, stemming
from the space sector”



Images: ImageCatalog from Noun Project





http://www.esa.int/About_Us/Business_with_ESA/Global_Space_Economic_Forum





Integrating space with non space: Global Space Economic Workshop on 13 October 2017

Bringing together for the first time 180 leaders and executives representing 55 space and 44 non-space companies from major global industries and European institution



3 parallel workshops to deal with **energy** and materials in extreme environments, **disabilities** and aging population, and **cybersecurity** of autonomous vehicles



First application to sponsor an **ESA Grand Challenge** was received by the UK Company Metalysis, and it is currently under study by the Executive before submission to the IPC for decision



Spontaneous proposals received to organise **follow up** of the GSEW in the course of 2018 focussing on specific topics





Types of Prize

High prestige science prizes

- Nobel Prize
- Fields medals
- Abel prize
- Lasker award

EX - POST

Blu Sky Prizes

In the recent decades, inducement prizes have made a comeback relative to traditional high prestige science prizes

Incentive or inducement prizes

- X-Prize



Targeted Prizes

EX - ANTE

High value science prizes

- Fundamental Physics Prize, 3M (est. 2012)
- Breakthrough Prize in Life Sciences, 3M (est. 2013)
- Tang Prize (est. 2013)

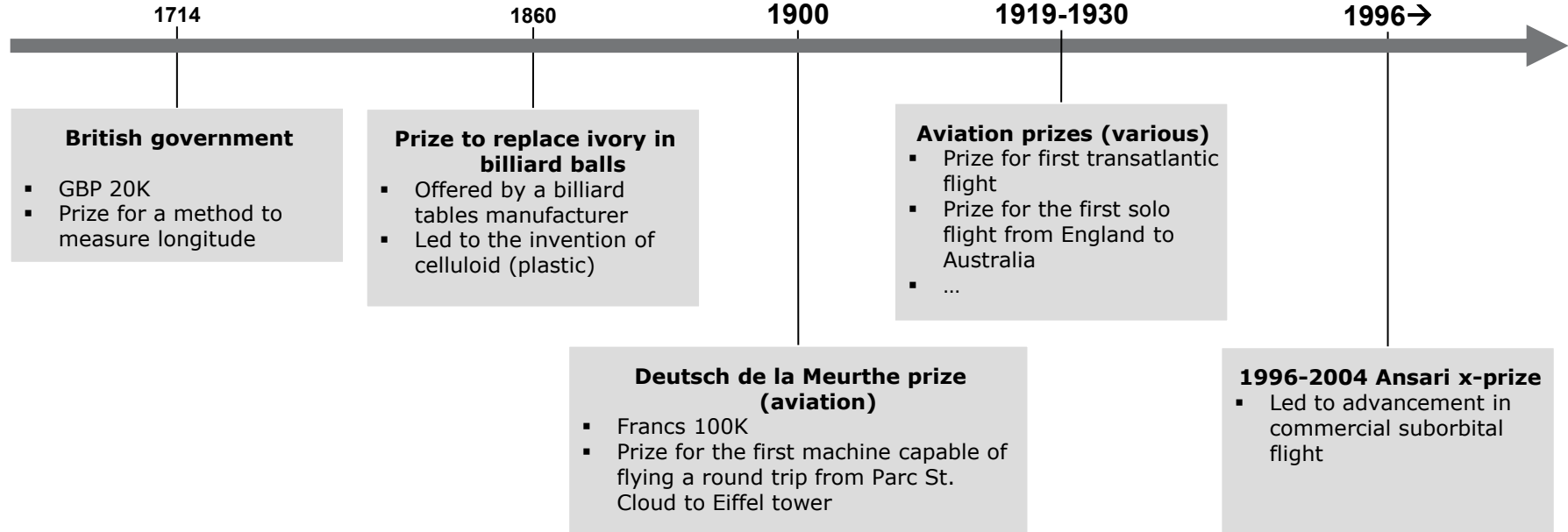
Prize-like public R&D grants

- EC - Future and Emerging Tech Flagship Competition (wide socio-economic benefit objective)

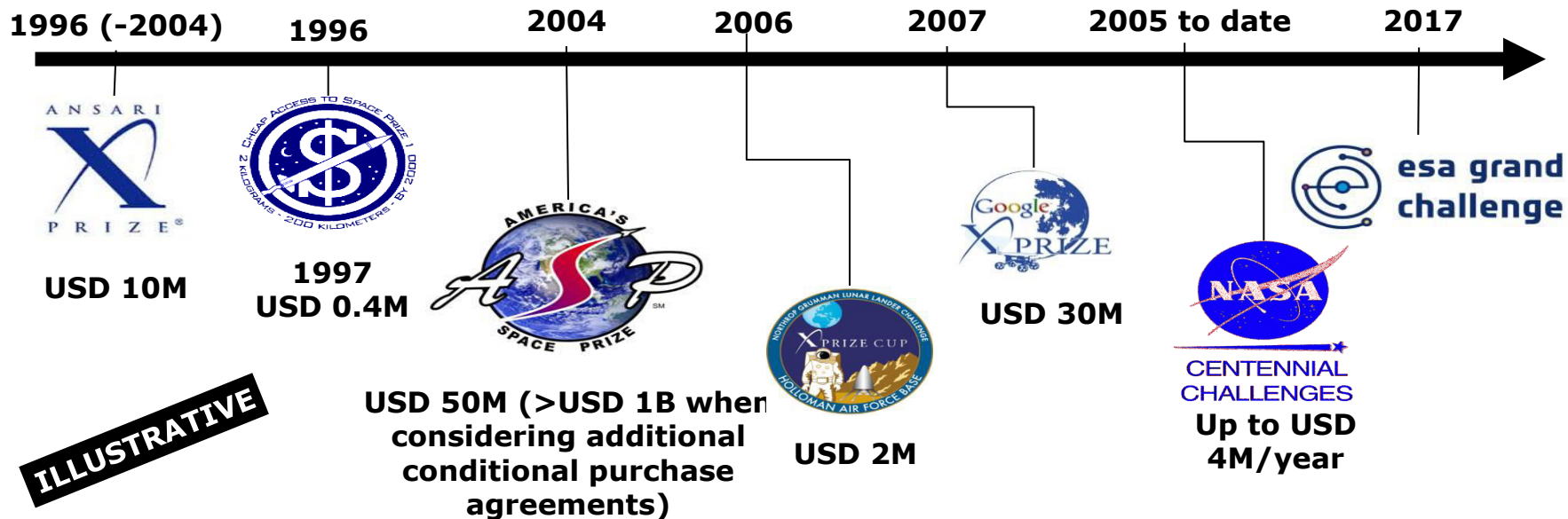
Historically, inducement prizes have been used extensively to propel scientific and technical innovation



Selected historical examples of use of Grand Prizes (non exhaustive)



The space sector has been a strong adopter of prizes since the 1990s



ILLUSTRATIVE

Why an ESA Grand Challenge?

Stimulus factor

May be used to:

- Encourage basic research
- Spur initial development of a new industry
- Focus efforts on problems that are not actively considered by the scientific/technical community
- Open and enhance existing technical communities dealing with certain challenges

Assets and resources retrieval

May be used to:

- Obtain intellectual property rights
- Identify bright researchers and problem solvers
- Obtain exclusive procurement rights on innovative technologies

Efficiency

May be used to:

- Increase the effectiveness of research funds, thanks to a multiplier effect on the prize funds originating from competitors' own investments
- Reduce the risk of public investment (by paying only in case of success)
- Reduce administrative and bureaucratic burden
- Circumvent govt budget spending rules (since prize funds is reserved for several years and doesn't need to be re-approved)

Outreach

- Raise the general public awareness on a given sector/issue
- Sponsorship may be used as promotional/marketing tool

Topic selection is a key starting point for prize design

General criteria to identify topics suitable for Inducement Prizes

Open to many possible solutions

High uncertainty on best option/solution to the problem

Room for lateral thinking

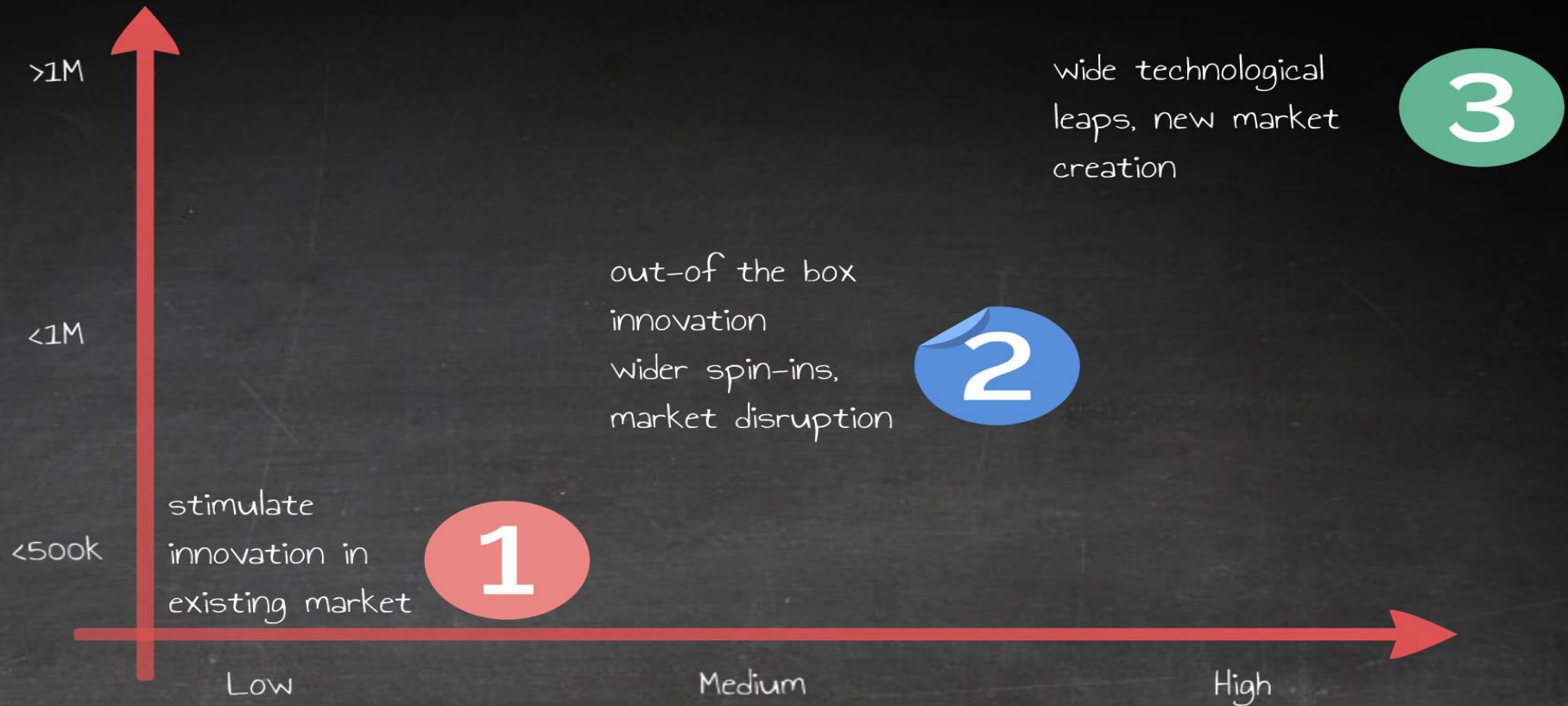
Accessibility to a larger community of potential problem solvers

Follow-up commercial interest (or, in this case, MS interest)

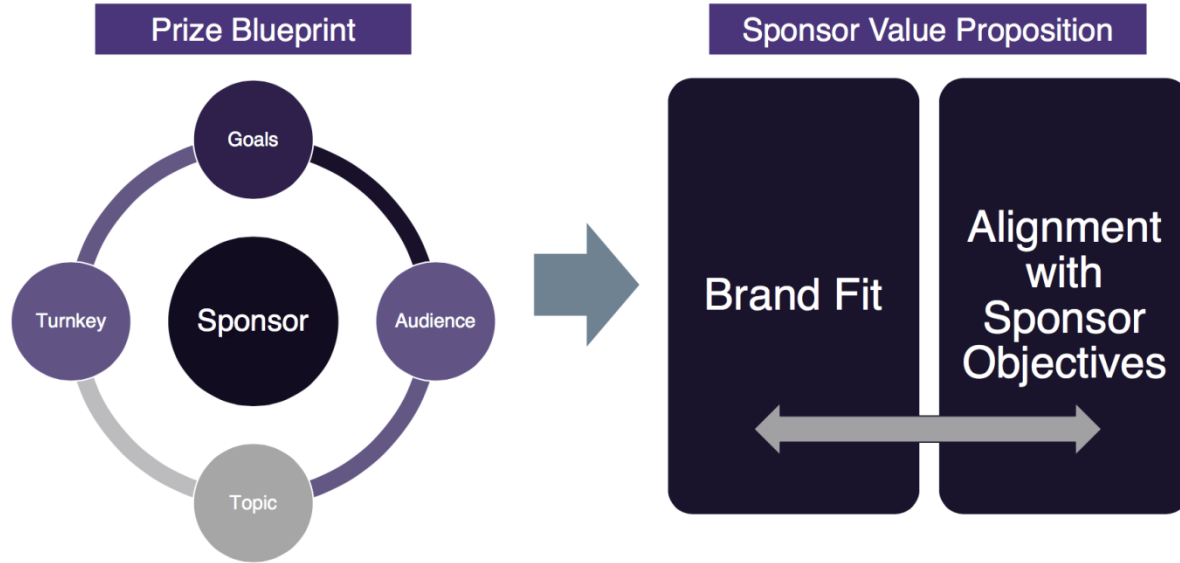
Challenge definition

- Clearly defined, with no room for interpretation on the intended objective
- No suggestions about specific technology developments
- Clear expected results, easily measurable

The definition of an adequate purse size may follow some general guidance but no definite rule



Keys to Success



9

The actual co-design of a challenge would require **strong interactions between ESA and the Sponsor/s** technical teams to target areas with high innovation potential interesting for the sponsor, and to define the specific rules of the competition.

Examples of Grand Challenges of potential interest for sponsors

The following slides introduce some **illustrative examples** of potential Grand Challenges relevant for different business lines promising also for further space and terrestrial applications.

Sponsor's benefits:

- ❑ Access to disruptive innovation + IPR
- ❑ Identification of new talents, startup
- ❑ Sponsor's brand associated to space exploration and technology
- ❑ Sponsor's brand visibility enhanced by ESA
Media Partners = extensive media campaign in all European Countries



*ESA can add its **unique** added value:
we can bring you in **space***



In space assembly and production



Examples of Grand Challenges of potential interest for sponsors



**Asteroid/Moon Mining
ISRU (Oil & Gas, food)**



Cyber Security



**Mobility
(Autonomous Vehicles,
drones)**



Space and Disability



**Sustainable
Development
Goals**



CYBERSECURITY SOLUTIONS



The rise of the Internet has triggered significant economic, social, cultural, political, and behavioral changes around the world, and its role in society continues to evolve. Average Internet users are extremely vulnerable as they lack awareness and a sense of cyber hygiene (the steps users should take to be safe online), and are frequently the target of cyber attacks.

Draft Guidelines

This Grand Challenge is focused on creating engaging and user-friendly cybersecurity solutions for consumers. The competition seeks to incentivize teams to create standards and technologies to secure the average connected consumer and ensure safer internet usage for all through the development of: (1) a cybersecurity standard for classifying and validating the security of users' connected environments; and (2) an engaging, effective, and easy-to-use cybersecurity solution for consumers that secures user environments to defined standards, reduces large-scale societal vulnerabilities in **critical infrastructure**, and helps create a more resilient society by ensuring greater cybersecurity for all.



Cybersecurity in space

Fly a cyber-protected cubesat and have the Blue team protecting it while the Red team tries to hack the spacecraft



BIONICS

EXAMPLE  esa

There are nearly 6 million people living without the use of their legs from paralysis or limb loss due to infection, injury, disease, postoperative complications or trauma. Currently, these individuals' only alternative for mobility is a wheelchair or walker. There are also tens of millions of aged adults with greatly reduced functional mobility who may be driven to institutional care as a result.

Draft Guidelines

This competition seeks to restore a paraplegic individual to normal capability. The winning team will develop an exoskeleton that can be put on and removed by the individual. The system must allow the individual to perform a number of baseline functions, including standing/sitting, using the toilet, climbing up and down stairs, walking 100 meters through a wooded trail, and standing from a horizontal position. All of this must occur with hands-free function.

The exoskeleton will be tested also under microgravity conditions (e.g. parabolic flights) by Paralympic athletes and flown on the ISS by an astronaut.



→ DESIGN THE PARALYMPIC ATHLET SPACE
GEAR

Just as Example

Join the
first sport
competition
in space



Space
technology
to improve
life of
physically
challenged
citizens

For more information visit:

http://www.esa.int/About_Us/Business_with_ESA/Global_Space_Economic_Forum

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