NEOs exploration and hazard
Science Exploration Strategy
for Robots and Humans

Motivations
Tentative practical roadmap
Exploration by Humans?
Approaches to follow the roadmap

Participants and/or contributors
NEOs exploration and hazard
Motivations (1/2)

Notes
• Quite a few (non coordinated) missions to small bodies under development by NASA & ISAS, one by ESA (Rosetta)
• Synergy between scientific goals and risk assessment needs

Scientific goals
Memory of the solar system formation / early history, and of the composition of the pre-solar nebula
Collisional history and diversity of the small body populations
Chemical composition and physical structure of small bodies

Risk assessment needs
Assessment of the threat of an impact and the consequences on the various extinctions of living species over the Earth history
NEOs exploration and hazard
Motivations (2/2)

NEO Hazard
“The least likely natural disaster, BUT probably the only one that can be predicted and avoided”
“Investing the resources in prevention of natural disasters”

2003  6 ESA pre-phase A studies completed
   NASA report: “Extending the NEO search to smaller limiting sizes”
   OECD workshop: “NEO, risks, policy and actions”
   ICSU assessment: “Comet/Asteroid Impacts and Human Society”
NEOs exploration and hazard
Tentative practical roadmap

Step 1 \(\approx\) before 2020
- Discovery, orbit determination and orbital evolution over decades of 90% Potentially Hazardous Objects (\(H < 20.5\), size > 200 m)
- Distribution of spectral types and albedos
=> Improved public communication and education

Step 2 from \(\approx 2005\) to 2030
- Physical properties (internal structure, composition, surface & sub-surface properties) through robotic in-situ measurements and sample returns, for a sub-set representative of the whole population
⇒ Implications for mitigation techniques
⇒ Assessment of potential natural resources
⇒ Public awareness and education on NEOs issues
NEOs exploration and hazard
Exploration by humans? (1/2)

Let’s be pragmatic,
and more realistic / innovative than the movies...
NEOs exploration and hazard
Exploration by humans? (2/2)
NEOs as a step towards Mars?

An example (from ≈ 2025)
R. Farquhar’s scenario for Deep Space Shuttle Orbit
- Intermediate stage for Humans on the way to Mars
- One year round-trip to an asteroid with 2 months on site
  ⇒ In-situ operations
  ⇒ Analysis of potential resources & mining activities
  ⇒ Public visibility and awareness
NEOs exploration and hazard
Approaches to follow the roadmap

1. Look beyond single projects or activities

2. Contribute significantly to public and national authorities awareness

3. Follow a stepped approach, within the framework of an international working group involving the different space agencies

4. Have a phase A study for a mission devoted to a rapid discovery and orbital determination of PHOs