
ISDC 2010 – May 27-29, 2010
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An Escalating Climate Crisis is Creating Challenges for Fresh Water

Reduced water – Western U.S.

a) Increasing urban and agricultural demands are even now not being met

b) “No Water – No Work” – 4000 farmers and laborers march for water in Central California San Joaquin Valley (04/2009)

Increased flooding – Mississippi Basin

a) Increasingly severe storms will result in more flooding in U.S. Mid West, including during winter

b) North Dakota flooding example (03/2009)
Challenges are Linked to Technology Issues

Clean energy & power grid upgrades
- a) How to reduce carbon footprint
- b) How to develop alternative energy
- c) How to upgrade the U.S. power grid

Water management
- a) More fresh water for Western U.S.
- b) More flood mitigation in Central U.S.
- c) Manage rising sea levels along all U.S. coastal areas
A 2010-2020 Solution-Set Includes Space Assets that can be Used to Help Solve Energy and Water Management Problems

- Can monitor & observe global climate change from space
- Can utilize new power sources (Solar Power Satellites-SPS)
- Must protect space systems as they are developed & used
  - debris – active monitoring & mitigation (LEO to GEO)
  - space weather – active monitoring & forecasting
    (GEO surface charging & deep-dielectric discharge from charged particles, LEO drag from neutral atmosphere, communication & navigation disruptions from ionosphere variability)
Space Water

Space Assets can Solve Terrestrial Problems – Facts

- **Fact:** Escalating climate crisis is resulting in severe, worldwide fresh water shortages
- **Fact:** Western U.S. is already experiencing reduced water & increasing demand that provokes water resource competition
- **Fact:** Coastal seawater desalination is a proven concept and can be a source for urban and agricultural water supplies if its associated large energy requirements can be effectively met
- **Fact:** Offshore oil & gas platforms are already using small scale seawater desalination for personnel and equipment use
- **Fact:** California coastal platforms are being considered for re-commissioning at the end of their productive lives
Space Assets can Solve Terrestrial Problems – Proposals

- Proposal: **Industrial-scale fresh water production** facilities can be built on re-commissioned oil & gas coastal platforms.
- Proposal: **Localized alternative energy on oil platforms** can provide partial power for daytime seawater desalination.
- Proposal: **Large-scale fresh water production** will require 24/7 operations and needs a significant localized power source.
- Proposal: **Solar power transmitted from orbiting satellites** can augment both day and night power generation at platforms.
- Proposal: **One GEO satellite can provide ~2 MW power for desalination** using clean energy & providing coastal fresh water to meet the daily requirements for a population of 50,000.
Elements of the Space Water Chain

Increasingly scarce fresh water ...

... jeopardizes agricultural and urban areas.

Fresh water can be produced by desalination facilities on converted oil platforms ...

... using clean energy transmitted to platforms from solar power satellites (SPS).
The Benefits of Space Water

- Globally
  - Legacy of a clean, no-carbon energy footprint for centuries
  - Solution for global fresh water production
  - Economic growth from new energy and water resources

- Nationally
  - Clean energy source for water production and electricity
  - Energy and water independence at forward military bases
  - Global leadership for developing 21st Century space assets
The Benefits of Space Water

• Regionally
  o Potentially unlimited fresh water for Southern California
  o Aerospace, energy, water, & agriculture sector jobs created

• Industrially
  o Water, power, and mineral industries – new resources
  o Oil & gas platform owners – lease revenues
  o Aerospace industry – access to space motivator
  o Farming – “water means jobs”
The Benefits of Space Water
SPS Design Competition

• **Online J. Space Communication** (http://spacejournal.ohio.edu/)
  - reporting on a global SPS design competition that links scientific communities and university-based digital media labs
  - promoting further understanding and active support of SPS development by government, industry, and the public

• SPS competition – Space Water is the 2010-2011 challenge
  - topics – space structures, assembly and repair, space environment, wireless power transmission and control, space transport, Earth receivers and converters, environmental health and safety, economics of alternative energy, business strategies, appropriate desalination technologies for SSP
  - resources – high-speed, high-resolution visualization center (GRID lab) at Scripps College of Communication, Ohio University (http://sunsat.gridlab.ohio.edu/)
Space Water Implementation

Needed now

- Agency coordination (DoD/NSSO, DoC/NOAA, DoI/MMS, DoE, NASA, NSF, EPA)
- Legislative action at state and federal levels
- Funding for government, industry, academia

Notional schedule

- 2010-2012 – technical/policy/economic studies
- 2012-2025 – component design, demo, implement
- 2025-2030 – prototype system construction
- 2030-2035 – space water demonstration