# is there a business case for a European space weather service?

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### why is a business case needed?

mitigation at user level not generally justified

coordinated European SW programme - economically justifiable?

what future is there for Europe in SW applications?



### what is a business case?

Benefit:Cost Ratio

1

method 1: +ve case

method 3: not as good as method

method 2: -ve case







## components of a business case







### programme





### levels of service (1/2) definitior

	LoS 1	ground- based	Magnetometers, Ionosondes, GPS, Solar Observatory, Neutron Monitor AND Auroral Imager, HF Backscatter Radar, Debris Tracker, Satellite Tracker	
WALL PROPERTY OF	LoS 2	hitch- hiker space	Whole disk imager, X-ray photometer, EUV photometer Debris monitor AND Auroral imager, UV photometer, Thermal energy ion spectrometer, High energy ion detector, High energy electron spectrometer, Personal dosimeter	
	LoS 3	dedicated space	Whole disk imager, Coronographs, X-ray photometer, Thermal energy ion spectrometer (L1), Upstream and Magnetospheric magnetometers, spectrometers, Radio spectrograph, wave detector AND Auroral imager, UV and EUV photometers, Electric field and thermal energy ion spectrometer, Debris tracker	



# levels of service (2/2)

	minimal option		maximal option		ion	
service type	Fore- cast	Now- cast	Post- cast	Fore- cast	Now- cast	Post- cast
geophysical survey						
GICs on ground						
aviation						
tourism						
communications						
spacecraft						
humans in space						
spacecraft launch						
spacecraft drag						

LoS 1	ground-based	
LoS 2	hitch-hiker - ground-based	F
LoS 3	dedicated - ground-based	F



### SDA domains

25 (+1 new) SDA across 7 domains:

- GIC and ground effects
- airlines
- GNSS applications
- communications
- tourism
- spacecraft
- research and education



# GIC and ground effects

SDA	Cost Data	Benefit Data
BINCAST		×
GAFS		some
GIC Now!	$\checkmark$	×
GIC Forecast	✓?	✓
GIC Simulator	×	×
GIFINT	$\checkmark$	qualitative
Pipeline SWS	×	×
SPECTRE	×	×
SWIMIC	$\checkmark$	1



### power line services (1/2) assumptions and caveate

- data source: GIC Forecast user report
  - forecast and nowcast
- SWS 80% effective in reducing SW impact
- SW impact cost ~€3.6/kWhr
  - 4 categories of SW impacts:
    - voltage collapse: nationwide, region
    - transformer failure: system, power plant
- scale up to all Europe + Canada

#### assumptions

- 100% reliability of SWS
- requires use of LoS 3 dedicated spacecraft



### power lines services (2/2) preliminary results



All Member States: GICs on Power Grids

optimistic scenario?

economic impact (~100 times revenue loss)



### aircraft services

SDA	Cost Data	Benefit Data
SOARS	×	×



## **GNSS** services

SDA	Cost Data	Benefit Data
Scintillation Quickmaps	<ul> <li>Image: A second s</li></ul>	✓
GPS Validation	×	×
SIDC		×
SWIPPA	<ul> <li>Image: A start of the start of</li></ul>	✓ some



### communications services

SDA	Cost Data	Benefit Data
Scintillation Quickmaps	✓	some
DIFS	×	qualitative
GIFINT	✓	qualitative
STIF	×	qualitative
lonosfera	free	free



### spacecraft services

SDA		Cost Data	Benefit Data
GEIS	HA		×
GEOSHA	<b>\FT</b>		limited
SAA	PS	×	×
SI	EIS	✓	coming
S	FC		×



### tourism services

SDA	Cost Data	Benefit Data
Auroras Now!	✓	1



### research and education

SDA	Cost Data	Benefit Data
BINCAST		some
lonosfera	free	free
ISGI		
Scintillation Quickmaps		some
SIDC	✓	qualitative
STIF	×	some
TSRS	$\checkmark$	qualitative



### developing the business case for Europe



### conclusions

- potentially positive business case
- levels of service streamlined according to return on investment
- better informed benefits data ⇒ potential future European
   SW market

