

Can the Sun black us out?

Space Weather Vulnerabilities and Weaknesses

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<http://ipsc.jrc.ec.europa.eu/>

- **Primary effects**

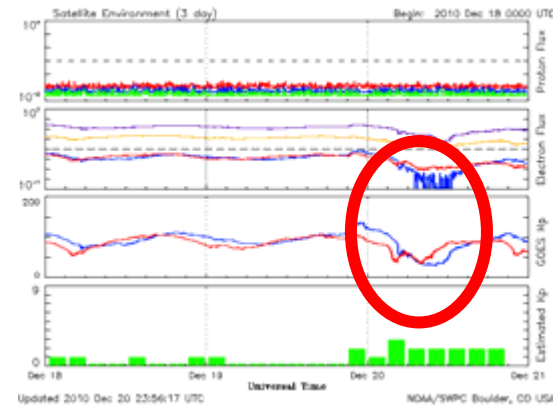
- Proton emission
- Electromagnetic energy
- Solar wind

- **Protective Measures**

- Shielding?
- Infrastructure reconfiguration!
- Infrastructure shutdown (!)

- **Secondary effects**

- Limitation or unavailability of service:
Satellite Services, Power Grid, Telco, ...

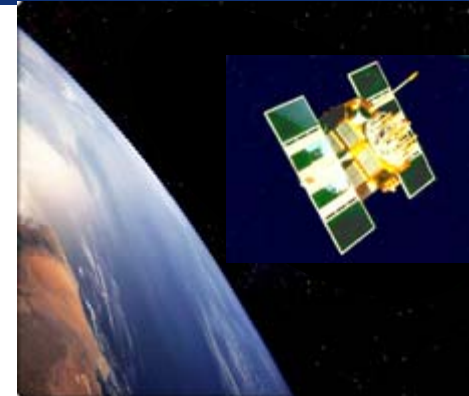


→ Heading for rough space weather?



“How long could our telecommunication networks operate without the GPS signal?”

Unfortunately, there is no simple answer!



“Email warning if GPS synchronised time is lost.”

***“Before an independent run,
24 hours of continuous GPS synchronization is required.”***

***“Fail-LED shows that the internal timing
has not been synchronized or that a system error occurred.”***

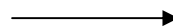
Current systems take the presence of a GPS signal for granted!

- Network Operators
- System Vendors
- Time Source Suppliers

- Service Providers
- Virtual Network Operators

Other sectors that rely on exact timing:

Customer industries of
a time reference manufacturer



- *Aerospace & Defence*
- *Digital Broadcast*
- *Financial Services*
- *Government & Civilian Agencies*
- *Manufacturing*
- *Public Safety*
- *Telecommunications*

Is this a serious problem at all?

- Operators might have **other time sources**
- Operators might have **primary** and **secondary** time sources
- Space Weather might have **little impact** on the GPS signal

There are around 200 Telco network operators in Europe!

- Networks were supplied by **different vendors**
- Networks can be **patchwork**
- Time synchronisation can be provided by **subcontractors**
- **Interdependencies** can occur between networks
- Alternate time sources (DCF) might **also be affected** by space weather

The field implementation matters!

Problem:

*“We (...) were running into **network timing problems.**”*

Fix:

The company tried a **GPS clock ...**

Result:

*“...our **problem (...)** has been reduced drastically ...”*

Customer Testimonial:

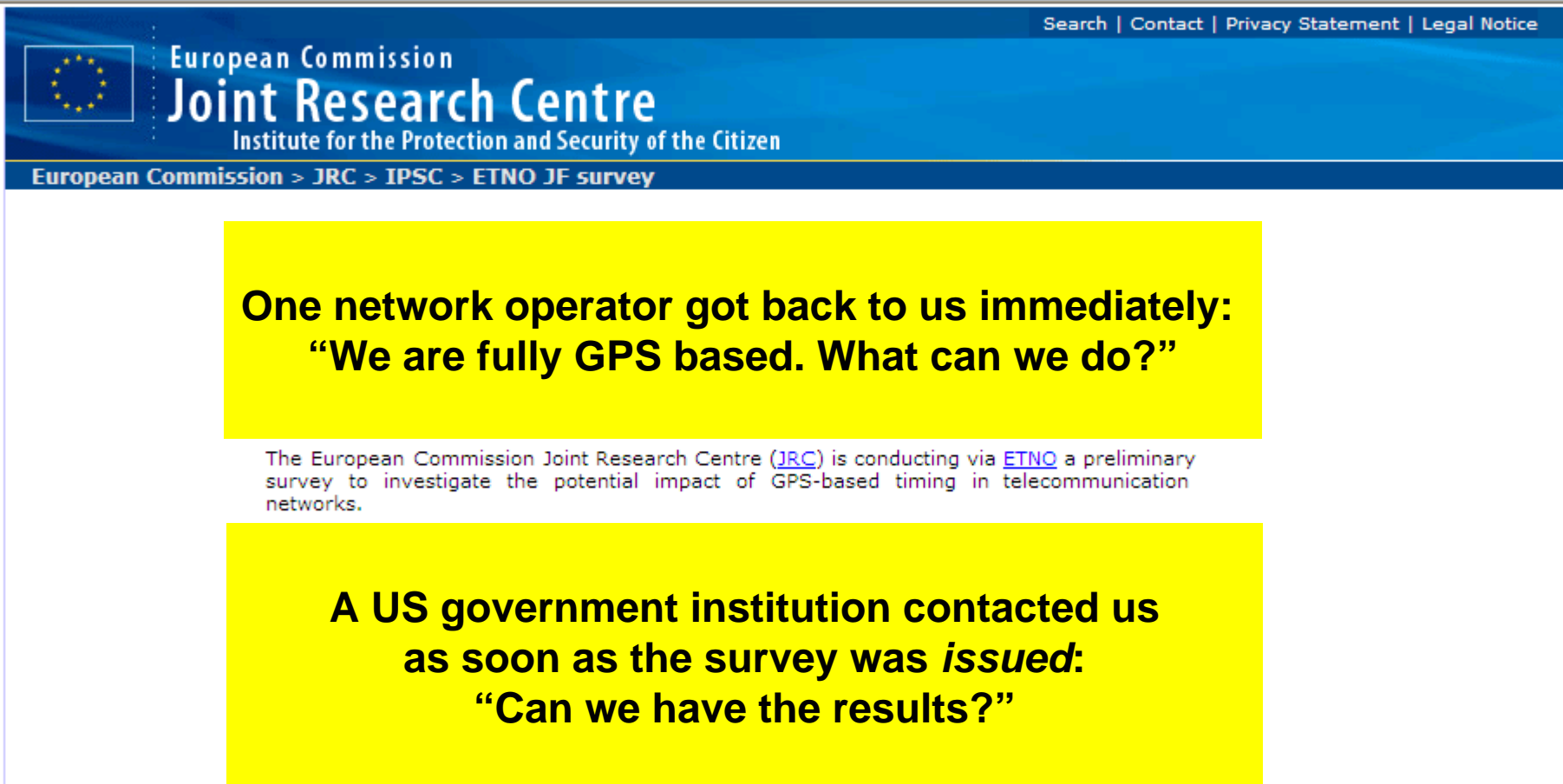
[REDACTED] is a full-service telecommunications company that owns and operates its own switching platform. We specialize in calling card services and have developed our own Point of Service software. We strive for high availability and [REDACTED] timing products help us realize our goal. We use the [REDACTED] series of telecommunications switches and were running into network timing problems.

We would derive switch timing from our incoming carriers, but instability of the network proved this solution unusable. Depending on the severity of the slips, it could cause clicks and pops, or in our case, cause circuits to go in and out of service. It affected our business since we had an increase of customer service complaints, which translates to unhappy customers. We called Spectracom to discuss possible solutions to our problem and came up with the combination of the Model [REDACTED] clock source and the [REDACTED] clock distribution amplifier to provide 24 T1 level stratum 1 clocking outputs. Since the implementation of the solution our problem of unstable spans has been reduced drastically where it isn't an issue for us. Having the reference clock made it a lot easier to troubleshoot circuits and reduced the amount of support required for our platform.

[REDACTED] Customer

GPS helped, but created a new dependency!

A 2011 quick JRC Survey has triggered surprising interest:



The screenshot shows a webpage from the European Commission Joint Research Centre. The header includes the JRC logo and navigation links for Search, Contact, Privacy Statement, and Legal Notice. The main content area features two yellow callout boxes with bold text. The first box states that a network operator immediately contacted them, asking what they could do. The second box states that a US government institution contacted them as soon as the survey was issued, asking for the results. Below the first callout, there is a paragraph of text describing the survey's purpose: to investigate the potential impact of GPS-based timing in telecommunication networks.

European Commission
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Institute for the Protection and Security of the Citizen

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European Commission > JRC > IPSC > ETNO JF survey

**One network operator got back to us immediately:
“We are fully GPS based. What can we do?”**

The European Commission Joint Research Centre ([JRC](#)) is conducting via [ETNO](#) a preliminary survey to investigate the potential impact of GPS-based timing in telecommunication networks.

**A US government institution contacted us
as soon as the survey was *issued*:
“Can we have the results?”**

- **We are far from understanding all implications**
- **Overreaction can make the situation worse!**
- **Transatlantic collaboration makes sense:**
JRC will contribute by interference measurements and vulnerability studies
- **Space Weather indeed is a problem:**
The solar activity peak around 2025 we find us even more vulnerable



Space Weather implications need more solid scientific research!