

Case Study

## Leap Seconds

### A public dialogue on maintaining leap seconds to synchronise clock and solar time

#### Vital statistics

**Commissioning body:**

National Measurement Office, an Executive Agency of the Department for Business, Innovation & Skills (BIS)

**Duration of process:**

12 months: March 2014 – February 2015

**Total public participants involved:**

111 involved in public workshops and 1,000 unique website visits

**Total stakeholders involved:**

21

**Total experts involved in events:**

12

**Cost of project:**

£175,000

Sciencewise funding = £85,000

*The specification for Coordinated Universal Time (UTC), the timescale used throughout the world, must be agreed internationally. Responsibility for this resides with the International Telecommunications Union (ITU).*

*In 2015, member countries of the ITU were to decide whether to maintain leap seconds, the mechanism by which clock time (based on UTC) is kept synchronised with solar time (time determined by the rotation of the Earth and the apparent movement of the Sun through the sky).*

*In recognition of the potential cultural and technical impacts of this decision, the National Measurement Office (NMO – now the National Measurement and Regulation Office) commissioned a public dialogue to gather evidence to support or reject the assumption that the public felt strongly that clock time should be linked to solar time. The dialogue was designed to inform the UK's view about whether leap seconds should be maintained or discontinued. There was also an interest that other countries had a chance to learn from discussions with the UK public and undertake similar exercises in their own countries to test their own assumptions.*

*The Leap Seconds Public Dialogue effectively tested the diversity and strength of public opinion about leap seconds, and was effective in filling the evidence gap. As a result, stakeholders were clear that the UK position, going into the international negotiations in 2015, could be informed by public views. The majority of participants believed it was important to maintain leap seconds.*

#### Policy maker view

“*The dialogue filled a crucial evidence gap and has given us a highly valuable understanding of the public's views on this difficult issue.*”

#### Post-dialogue stakeholder interview

#### Influence on policy and policy makers

The dialogue process was designed to gather evidence to inform the UK Government's thinking about its position at the 2015 International Telecommunication Union (ITU) conference.

The dialogue successfully informed the UK's policy position on this issue. The dialogue was encouraged by the then Minister, the Rt Hon David Willetts MP. The results were used as evidence to inform

his successors, the Rt Hon Greg Clark MP and the Rt Hon Jo Johnson MP. The findings of the dialogue were published with the statement that the dialogue 'has helped inform policy on this issue. All four strands of the public dialogue indicated that the public has a strong preference for continuing to use leap seconds to maintain the link between time and the sun.'

The dialogue findings were discussed at NMO's meetings with Ofcom (which led the UK delegation at the World Radio Conference (WRC) in November 2015).



## Background

The timescale most commonly used for all precise timekeeping in the UK and internationally is UTC. It is maintained by highly accurate atomic clocks around the world and is the basis for civil timekeeping in the UK. Historically, time has been determined by the earth's rotation and the sun's location in the sky. However, earth's rotation is irregular and slowing over the long term. This means that any timescale determined by accurate measuring devices such as atomic clocks (e.g. UTC) are slowly falling out of synchronisation with solar time.

To keep UTC and solar time synchronised, 'leap seconds' are periodically added to UTC to adjust for the irregularity in the earth's rotation. This ensures that the difference between UTC and solar time is no more than 0.9 seconds, and that the historical correspondence between the time on our clocks and the position of the Sun in the sky is maintained.

The periodic insertion of leap seconds can cause problems to systems such as computers and communications networks, so there have been proposals to cease their use. Ceasing use of leap seconds would result in a gradual separation between solar time and UTC. The 2012 ITU Radiocommunication Assembly (ITU-RA) considered a proposal to end the intermittent insertion of leap seconds in UTC. International views were strongly divided and a large number of countries had not considered the issue. Therefore, to allow further studies to be carried out, the ITU-RA members postponed making any decision until the WRC in 2015.

The Leap Seconds Public Dialogue was launched to inform the UK's position leading up to WRC in 2015.

At these meetings the main findings of the dialogue report were explained and UK delegates were encouraged to discuss the dialogue findings at international meetings with representatives of other countries.

In addition, Robert Gunn, Director of Programmes and Estates at NMO, attended a Conference Preparatory Group (CPG) meeting of the Electronic Communications Committee (ECC) in Malta in January 2015. The ECC's CPG was responsible for developing briefs, studies and European Common Proposals for the WRC. Robert Gunn informed the representatives of other countries about the findings of the dialogue, encouraged them to undertake similar work and pointed them to the website if they wanted to find out more.

In November 2015, at the WRC, the ITU decided that 'further studies are required on the impact and application of a future reference timescale', including suppressing the leap second. A report is to be considered at the next WRC in 2023. Until then, leap seconds will continue to be applied.

## Key messages from the participants

### Initial stakeholder workshop

A preliminary stakeholder workshop was designed to provide input to the design and delivery of the public dialogue events. The workshop participants identified a number of impacts they thought

relevant to the process. These included impacts on technology, defence, astronomy, meteorology, finance and navigation.

Stakeholders also discussed religious, cultural and social implications. Most believed that it was important to maintain leap seconds because they variously thought that the link between solar time and atomic time was a symbolically important link with our past and that discontinuing leap seconds would threaten our legacy for future generations. A small number of stakeholders thought that discontinuing leap seconds would have positive social impacts.

*“ It is extremely important [that public views are heard] I was quite shocked at the fact so many people have never heard of leap seconds including me and how the decisions could have been made with no mention to the public.”*

Public participant, Cardiff

Public dialogues (descriptions of dialogue activities are given later)

Participants at the public dialogue workshops expressed a clear preference for maintaining the link between clock time and solar time. Many participants were sceptical of the argument that programmers would not be able to deal with the impacts that leap

seconds have on technological systems. Participants also discussed potential impacts on air traffic control, the financial industries, navigation and astronomy, often suggesting that the impacts were too contested for them to be able to come to a firm view.

*“I had totally made up my own mind by the time I came out. I felt extremely clear about the influence of it, everybody was listened to carefully and I feel confident that the conversations from the workshop would get back to the relevant people.”*

Post-dialogue participant interview, Belfast

### Pop-up dialogues

The participants involved in the pop-up dialogues were more indifferent to the issue than those involved in other aspects of this dialogue project. In common with findings from other areas of the dialogue project, key concerns of those who had an opinion were around maintaining links with natural cycles unless it was essential to change.

### Digital engagement

Nearly 200 individuals responded to the dialogue project's online survey. Around 90% felt they knew a lot or a bit about leap seconds, 61% were strongly in favour of continuing to use leap seconds to keep clocks in time with the sun and 68% suggested they would have some concerns or feel angry if leap seconds were discontinued. In total, 11% of respondents were strongly or somewhat against continuing to use leap seconds and almost 20% said they would have had no strong reaction if leap seconds were discontinued.

### The dialogue activities

This public dialogue project was developed to gather evidence to either support or reject the assumption that the public feel strongly that clock time should be linked to solar time. The purpose of the dialogue was to:

- To discover the diversity of opinion, and strength of opinion, of the linkage between time and the motion of the Earth through consultation with the general public, religious, and scientific communities
- To share with different stakeholders the impacts of: maintaining the link between earth rotation and atomic time (keeping leap seconds) and of; dropping leap seconds as being proposed.

The project included the following elements:

- Establish an oversight group to guide the project design, delivery and evaluation
- Carry out desk research and interviews to identify stakeholders
- Scope stimulus materials for workshops and content for the website
- Conduct a national stakeholder workshop
- Carry out an online survey and discussion forum

- Facilitate two rounds of public workshops in four different locations
- Arrange two pop-up dialogues
- Carry out reporting and evaluation.

In April 2014, a **national stakeholder workshop** was held in London. It was attended by 26 people who represented areas such as navigation, astronomy, meteorology, IT and communications, religion, engineering and time measurement. The workshop mapped the issues involved in maintaining or discontinuing leap seconds and then ranked them in order of significance. The stakeholders agreed that it was important to consult the public on these issues and their discussions contributed to the engagement approach that should be taken in dialogue events with the public.

The **leap second website**<sup>1</sup> was launched after the stakeholder workshop to complement the public workshops and engage with a wider section of the public. The website included a discussion forum, background information, frequently asked questions (FAQs), a glossary and other relevant resources to which the dialogue materials were added throughout the project duration. Around 1,000 unique users, mainly from the UK and USA, browsed the web pages and just under 200 users completed an online survey.

During June and July 2014, **public workshops** were held in Edinburgh, Belfast, Tamworth and Cardiff. In each location, there was one half-day workshop, followed by a reconvened full-day workshop. Public participants were recruited according to a detailed recruitment specification. A total of 111 public participants took part. Experts were present at six of the eight workshops to discuss topics with participants and answer their questions.

Two **pop-up events** were held in the London area – one in Kingston town centre (which resulted in 12 conversations) and one at the National Maritime Museum in Greenwich (21 conversations). The pop ups were intended to test whether the framing of the issue had an impact on how respondents engaged with the subject. When the issue was reframed from being about technology and timescales to being about keeping time in line with the sun, several people changed their opinion from indifference to wanting to maintain the link to the sun for 'natural' or 'traditional' reasons.

**A range of reports** was produced including one on the desk research findings and separate reports on the results of workshops in each location. The full final dialogue report was published in February 2015. It covered the context, methodology and findings of all elements of the stakeholder and public events.

**Dissemination** activities included publicising the reports and making them available on the NMO and Sciencewise websites. Results were also passed to Ministers at the end of 2014 and presented at various events leading up to the WRC in November 2015 (see Impacts section). A Sciencewise webinar was held in March 2015 to share the experience of the project.

A journalist who wrote on science and time was included in the Oversight Group so that where and when appropriate, the public would be able to read about the process in articles written by a professional<sup>2</sup>.

<sup>1</sup> <http://leapseconds.co.uk>

<sup>2</sup> For example: 'The pros and cons of leap seconds', New Statesman, 8 May 2014; 'Should we stop time', The Independent, 30 June 2014; 'Get ready for the leap second – it could be the last one ever', New Scientist, 23 June 2015.

## What worked especially well

### Project management, design and delivery

Effective governance and project management ensured the project was delivered on time, to budget and that it met the agreed objectives. Appropriate design and facilitation tools were used to draw out views and challenge participants to work with stakeholders to think through the issues. The mixed methodology of video, role play, quiz, prioritisation exercises and small group discussion were valued as a means to understand the issues. The research for the materials was particularly effective, leading to the creation of a design that took participants on a journey of a discovery. The dialogue remained unbiased with objective facilitation throughout. Participants generally appreciated the discussions for being interesting, respectful and fair.

### Participant satisfaction

Very high numbers of public participants agreed or agreed strongly that they had benefited personally from the project – 87% in Edinburgh, 92% in Belfast, 96% in Tamworth and 100% in Cardiff. They valued meeting facilitators, specialists and fellow participants who they enjoyed talking to; they gained an understanding of an issue that was new to them; and had the opportunity to air their views on a complex issue. Nearly three-quarters of stakeholders said they agreed or strongly agreed that they had gained knowledge about the leap seconds policy area. The majority of stakeholders felt that the project demonstrated good value for money.

## What worked less well

### Stakeholder engagement

Involving stakeholders was a challenge for the project. Some stakeholders were not willing to engage with the dialogue as the subject was in negotiation at a global level and others were not aware of the issue at all or did not recognise that they had a stake in it. Timing was also an issue – there was little time between the start of the project and the planned stakeholder workshop. Ideally, stakeholders need to be identified and engaged well in advance of the project start date.

Despite the dialogue contractor's best efforts to gain specialist involvement, there was an insufficient number of stakeholders available to the project. There were also gaps in expertise in specific areas (such as culture, faith, IT and defence). However, work was done to fill these gaps by means of video and written communications from those with a different view from the existing UK position. As a result, the dialogue was still an effective way of testing public views. The mixed methodology dialogue, the extensive research into the issue to cover all aspects of the debate, the use of online as well as physical engagement, the production of clear stimulus materials and the very effective briefing of the facilitation teams meant that the credibility of the findings was not compromised by limited stakeholder engagement.

### Governance

The overall governance of the project was fairly effective although the Oversight Group would have benefited from the creation of a tailored terms of reference document. At some points, the Oversight Group members were not clear of the expertise of others in the room or the commitment they had made in agreeing to take part in the process.

### Lack of specialist input to some public workshops

No experts were present at the Edinburgh workshop, partly due to the difficulties in engaging stakeholders. The evaluators found that the more stakeholders and experts that were present at the public dialogue events, the more participants asked questions and the livelier was the discussion. In Tamworth, there was a very full discussion over two sessions, but in Edinburgh, where there were no experts present, it was much harder to engage people.

*“ Pick the experts beforehand and target individuals for particular sessions with a longer lead-in time. Perhaps all Oversight Group members should have been offered a fee for weekend attendance.”*

Post-dialogue stakeholder interview

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#### Reports

Full project and evaluation reports available from Sciencewise on [www.sciencewise-erc.org.uk/cms/leap-seconds](http://www.sciencewise-erc.org.uk/cms/leap-seconds)