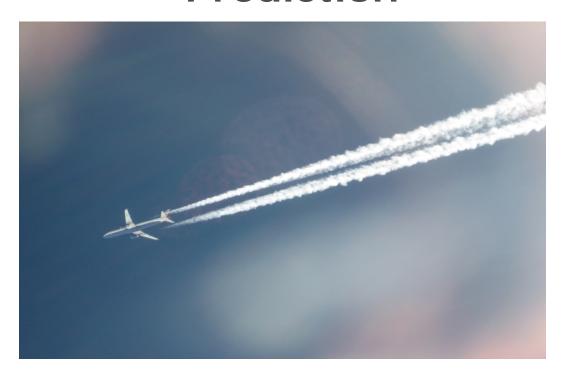# The Impact of NANUs on RAIM Prediction

John Wilde
Director, DW International

- DW maintains a database of future satellite outages for use in RAIM predictions
- The database is kept up-to-date automatically via subscribed GPS updates
  - Typically these updates take the form of *Forecast Outage* and *Unscheduled Outage* type NANUs which follow a defined syntax and can be reliably parsed for DW's internal use
  - Other *General* type NANUs are free-text information updates which require manual system input

- RAIM predictions are typically calculated for 72 hours into the future
- Our systems therefore rely on the availability of the latest constellation updates as they can impact the current prediction scenario period

- ## NANU 2009070 details a Forecast Maintenance outage for PRN 26 from 09:30 to 21:30 on 28th Sept 2009:

```
NOTICE ADVISORY TO NAVSTAR USERS (NANU) 2009070
SUBJ: SVN26 (PRN26) FORECAST OUTAGE JDAY 271/0930 - JDAY 271/2130
1.      NANU TYPE: FCSTMX
        NANU NUMBER: 2009070
        NANU DTG: 162050Z SEP 2009
        REFERENCE NANU: N/A
        REF NANU DTG: N/A
        SVN: 26
        PRN: 26
        START JDAY: 271
        START TIME ZULU: 0930
        START CALENDAR DATE: 28 SEP 2009
        STOP JDAY: 271
        STOP TIME ZULU: 2130
        STOP CALENDAR DATE: 28 SEP 2009
```

- NANU 2009052 details an outage for PRN 25 from 15:00 on 20th August 2009 until further notice:

```
NOTICE ADVISORY TO NAVSTAR USERS (NANU) 2009052 NANU TYPE: GENERAL
*** GENERAL MESSAGE TO ALL GPS USERS ***
SVN25 (PRN25) FORECAST OUTAGE ON JDAY 232/1500Z UNTIL FURTHER NOTICE.
GPS SATELLITE SVN 25 (PRN25) WILL BE UNUSABLE NO EARLIER THAN JDAY 232
(20 AUG 2009) BEGINNING 1500Z UNTIL FURTHER NOTICE.
*** GENERAL MESSAGE TO ALL GPS USERS ***
```

- Manual intervention was required to generate a system-parsable outage type
- PRN 25 was subsequently removed from the Almanac

- ## Unscheduled Outage type equivalent:

```
NOTICE ADVISORY TO NAVSTAR USERS (NANU) 2009052
SUBJ: SVN25 (PRN25) UNUSABLE JDAY 232/1500 - UNTIL FURTHER NOTICE
1.      NANU TYPE: UNUSUFN
        NANU NUMBER: 2009052
        NANU DTG: 181200Z AUG 2009
        REFERENCE NANU: N/A
        REF NANU DTG: N/A
        SVN: 25
        PRN: 25
        START JDAY: 232
        START TIME ZULU: 1500
        START CALENDAR DATE: 20 AUG 2009
        STOP JDAY: UFN
        STOP TIME ZULU: N/A
        STOP CALENDAR DATE: N/A
```

- *Forecast Outage* type NANU (FCSTDV/MX) issued (applying from 3pm 20th August UFN) detailing future outage of PRN25

- *Forecast Summary* type NANU (FCSTSUMM) issued detailing actual outage (PRN25 was set unusable UFN at 3:14pm on 20th August) and referencing original Forecast NANU

- *Forecast Cancellation* type NANU (FCSTCANC) issued detailing PRN25 is now usable (from 12th September) and referencing original NANU

PRN 25 – Actual Event Summary

- 14th August: GENERAL NANU 2009052 received (applies from 3pm 20th August) detailing forecasted outage UFN of PRN25

- 18th August: Equivalent UNUSUFN NANU generated by DW and input into system

- 20th August: GENERAL NANU 2009054 received detailing that PRN25 was set unusable at 3:14pm on 20th

- 21st August: PRN 25 removed from almanac

- 12th September: GENERAL NANU 2009067 received detailing PRN25 usable from 12th Sept

- *Standardisation of event reporting required*

- *Use computer readable fixed formats*

- *Leave 'general' free text for information*

- *Lets help one another to interpret NANUs for the user*

john.wilde@dwint.com   www.dwint.com