RINEX

I. Romero (RINEX WG Chair)
ESA/ESOC/Navigation Support Office

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RINEX – a resounding IGS format success!!

- ▶ RINEX format thanks to Werner Gurtner (AIUB), Gerald Mader (NGS), Lou Estey (UNAVCO), Ken MacLeod (NRCan)

- ▶ Helping to exchange GNSS data since 1990.

- ▶ Adopted by receivers and by commercial and scientific software as an international standard.

- ▶ RINEX format maintained jointly in the RTCM/IGS RINEX WG to engage industry and the scientific community and encourage early and wide adoption.

- ▶ The RTCM/IGS RINEX WG works to maintain alignment with streaming data formats to maintain accuracy and precision in GNSS observations.

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RINEX – Content & Evolution

- The workhorse format for GNSS data;

  - Stores measurements to all GNSS satellites; code, phase, SNR, doppler

  - Used for Precise Orbit Determination, Precise Point Positioning, Geodesy, Ionosphere, Time transfer, etc

  - 3 different RINEX file types; Observation, Navigation, Meteorological

- RINEX format has evolved over time to accommodate the observations of all GNSS systems RINEX 2.XX (1990)→ 3.XX (2007)

- RINEX format navigation data format is evolving to keep pace with modernized GNSS navigation messages RINEX 3.XX (2020)→ 4.XX (2021)

RINEX 4.00 – So What will be New? (TBC)

▶ New QZSS Observations added, header lines declared optional, clarified and simplified text.

▶ Navigation Message Taskforce finalized RINEX 4 proposal with;

 ▶ Old & new navigation messages in traditional matrix form – fully identified; LNAV, CNAV, CNAV2, INAV, FNAV, FDMA, D1, D2, CNV1,etc.

 ▶ Navigation "data record" concept; **EPH, ION, EOP, STO**

  ▶ **EPH -** traditional satellite ephemerides data

  ▶ **ION -** Ionosphere model coefficients into full messages, from single header lines

  ▶ **STO -** Time Offset full messages, previously contained as optional header lines

  ▶ **EOP -** Earth Orientation Parameters system messages

RINEX 4.00 - Navigation Messages - Examples

```
>EOP C20 CNVX
      2020 09 15 00 00 00 2.084112167358e-01-3.948211669922e-04 0.000000000000e+00
                          3.408145904541e-01-1.317977905273e-03 0.000000000000e+00
      1.749900000000e+05-1.752023100853e-01 2.140104770660e-04 0.000000000000e+00
>EOP J01 CNVX
      2020 09 15 01 00 00 2.082471847534e-01-6.551742553711e-04 0.000000000000e+00
                          3.444433212280e-01-9.121894836426e-04 0.000000000000e+00
      1.729860000000e+05-1.754972934723e-01 5.635917186737e-04 0.000000000000e+00
>ION E14 IFNV
      2020 09 15 00 11 04 3.725000000000e+01 1.250000000000e-01 9.246826171875e-03
      0.000000000000e+00
>ION C05 D1D2
      2020 09 15 00 00 00 1.024454832077e-08 0.000000000000e+00-2.384185791016e-07
      4.768371582031e-07 1.269760000000e+05-4.423680000000e+05 3.145728000000e+06
     -2.228224000000e+06
```

```
>EPH R04 FDMA
R04 2020 09 15 22 45 00 5.470402538776e-05 9.094947017729e-13 2.541000000000e+05
      1.043976806641e+04-2.930776596069e+00 3.725290298462e-09 0.000000000000e+00
      8.152179687500e+03 5.874986648560e-01 0.000000000000e+00 6.000000000000e+00
     -2.177643408203e+04-1.184345245361e+00 9.313225746155e-10 0.000000000000e+00
      2.430000000000e+02-2.793967723846e-09 4.000000000000e+00 3.000000000000e+00
```

```
> EPH E11 FNAV
E11 2020 09 15 23 30 00 5.537368822843e-03 2.744400262600e-10 0.000000000000e+00
      4.500000000000e+01 1.730312500000e+02 2.871548182937e-09-1.103934352668e-01
      8.083879947662e-06 2.968260087073e-04 3.607943654060e-06 5.440606000900e+03
      2.574000000000e+05-5.774199962616e-08 8.098963343817e-01-1.005828380585e-07
      9.891873024559e-01 2.774062500000e+02 1.248848716430e+00-5.818456647788e-09
      5.564517498775e-10 2.580000000000e+02 2.123000000000e+03
      3.120000000000e+00 0.000000000000e+00-1.583248376846e-08 0.000000000000e+00
      2.581000000000e+05
```

```
> EPH J01 CNV2
J01 2020 09 15 23 00 00-3.468278155196e-04 3.051781050090e-12 0.000000000000e+00
      1.153469085693e-02-1.025792968750e+03 9.561112544429e-10 1.146894820453e+00
     -3.370456397533e-05 7.432970730588e-02 1.764204353094e-05 6.493079715316e+03
      2.556000000000e+05-1.918524503708e-07 2.617854812024e+00-4.172325134277e-07
      7.285778780674e-01-2.423671875000e+02-1.567309926761e+00-2.471475038906e-09
     -1.273267322409e-10-6.402418611657e-14-3.000000000000e+00 0.000000000000e+00
     -5.000000000000e+00 0.000000000000e+00-5.500623956323e-09 0.000000000000e+00
      4.365574568510e-10 2.910383045673e-10
      2.520180000000e+05 2.123000000000e+03
```

```
>STO E    IFNV
      2020 09 15 00 00 00 GAUT                    UTCGAL
      1.735000000000e+05-1.862645149231e-09 0.000000000000e+00 0.000000000000e+00
>STO G24 CNVX
      2020 09 18 19 56 48 GPUT                    UTC(USNO)
      2.532240000000e+05 9.895302355289e-10-1.154631945610e-14 0.000000000000e+00
>STO E    LEG
      2020 09 16 00 00 00 GAGP
      2.173000000000e+05 2.299202606082e-09 0.000000000000e+00 0.000000000000e+00
>STO I02 LNAV
      2020 09 15 00 04 48 IRUT                    UTCIRN
      1.731720000000e+05-8.614733815193e-09-1.776356839400e-15 0.000000000000e+00
>STO I02 LNAV
      2020 09 15 00 04 48 IRUT                    UTC(NPLI)
      1.732200000000e+05 2.619344741106e-10 3.996802888651e-15 0.000000000000e+00
>STO J02 LNAV
      2020 09 18 02 52 48 QZUT                    UTC(NICT)
      1.837140000000e+05-9.313225746155e-10 0.000000000000e+00 0.000000000000e+00
```

```
> EPH C06 D1
C06 2020 09 15 01 00 00-3.242515958846e-06 1.852118458601e-11 3.659182332139e-19
      8.000000000000e+00 1.426562500000e+01 9.714690370133e-10 1.246933080796e+00
      1.228414475918e-06 9.890956804156e-03 2.590520307422e-05 6.493081556320e+03
      1.764000000000e+05 8.381903171539e-08-2.972005703898e+00 3.804452717304e-07
      9.463123714915e-01-5.693125000000e+02-2.191348522988e+00-1.732215010851e-09
      1.288982262714e-09 0.000000000000e+00 7.670000000000e+02 0.000000000000e+00
      2.000000000000e+00 0.000000000000e+00 8.700000000000e-09-1.800000000000e-09
      1.764000000000e+05 7.000000000000e+00
> EPH C19 CNV1
C19 2020 09 15 01 00 00 5.465495632961e-04 1.388134052149e-11 0.000000000000e+00
      5.006313323975e-03-1.506875000000e+02 3.571041605360e-09 1.003690746903e+00
     -7.358379662037e-06 6.369716720656e-04 1.230742782354e-05 5.282627076197e+03
      1.764000000000e+05 4.470348358154e-08 2.456987198602e+00 3.725290298462e-09
      9.644664336468e-01 1.128671875000e+02-9.872580887479e-01-6.639026542104e-09
     -2.392956819114e-11-4.739141321669e-14 3.000000000000e+00 1.764000000000e+05
      0.000000000000e+00-5.000000000000e+00 0.000000000000e+00-1.000000000000e+00
     -4.656612873077e-10                     1.164153218269e-08-3.201421350241e-09
      1.000000000000e+00 0.000000000000e+00 0.000000000000e+00 2.100000000000e+01
      1.764000000000e+05                     2.100000000000e+01
```

RINEX – Participation and Feedback

▶ RINEX WG is open to all IGS Associate members and to RTCM SC104 members.

▶ Early RINEX format adoption and testing is necessary and encouraged.

▶ Feedback from the GNSS community helps keep the format 'fit for purpose', please use the new website form;

https://igs.org/wg/rinex/#feedback

RINEX

The IGS Receiver INdependent EXchange (RINEX) Working Group (RINEX-WG) was
RINEX format to meet the needs of the IGS and the GNSS Industry. Since the RINEX
it should be jointly managed by the IGS and Radio Technical Commission for Mariti
the working group consists of both IGS and RTCM-SC104 industry members. Docur
based approach and majority voting will be used if a consensus cannot be reached
to be freely distributed both by the IGS and RTCM-SC104.

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RINEX WG Feedback

Subject

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0 of 2000 max characters

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Thank You

WG CHAIR: IGNACIO (NACHO) ROMERO

Ignacio.Romero@esa.int