

(Satellite)



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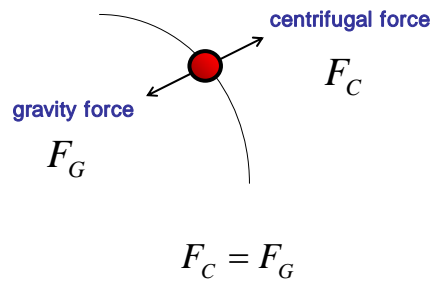
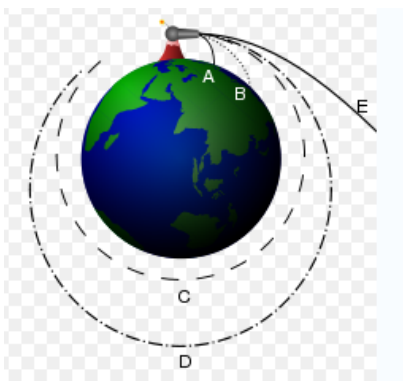
- History
- Basics
- Satellite Types
- Orbit types
- Organization of Satellite system
- Space environment
- Earth observation satellite
- Weather satellite
- GNSS
- Communication satellite

History (2)

- 1960-
 - 1961.5 - (United States)
 - 1969.7.21 – apollo 11 (Soviet Union)
- 1970-
 - 1975.7 – 18 (US), 19 (SU)
 - (Soviet Union)
 - 1981.4.12 Space Shuttle Columbia
- 1980-
 - 1985. Open Skies (US),
- 1990-
 -
 -



Basics



Basic (2)

■ 1

$$F_C = F_G$$

$$m \frac{v_c^2}{r} = \frac{GMm}{r^2}$$

$$v_c = \sqrt{\frac{GM}{r}}$$

: 7.9km/s

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$(K + U_g)_i = (K + U_g)_f$ K: kinematic energy, U: Potential energy

$$\frac{1}{2}mv_e^2 + \frac{-GMm}{r} = 0 + 0 \quad v_e = \sqrt{\frac{2GM}{r}}$$

: 11.2km/s

Satellite Type

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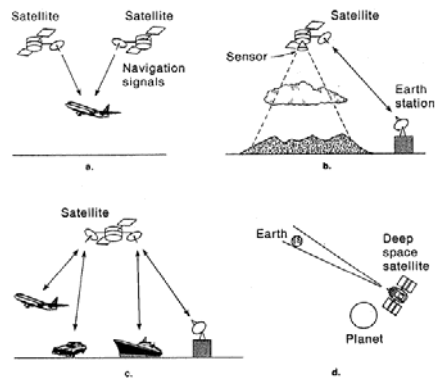


FIGURE 1.3 Satellite uses. (a) Navigation and position location; (b) terrain and weather observation; (c) data networking; (d) deep-space exploration.

Satellite Type

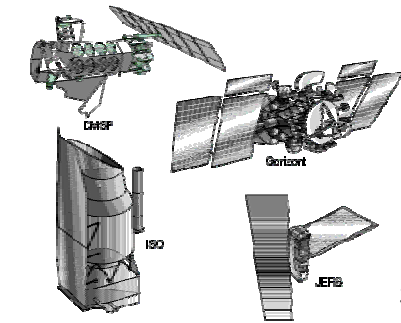


■ 3

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: Gyroscopic stiffness



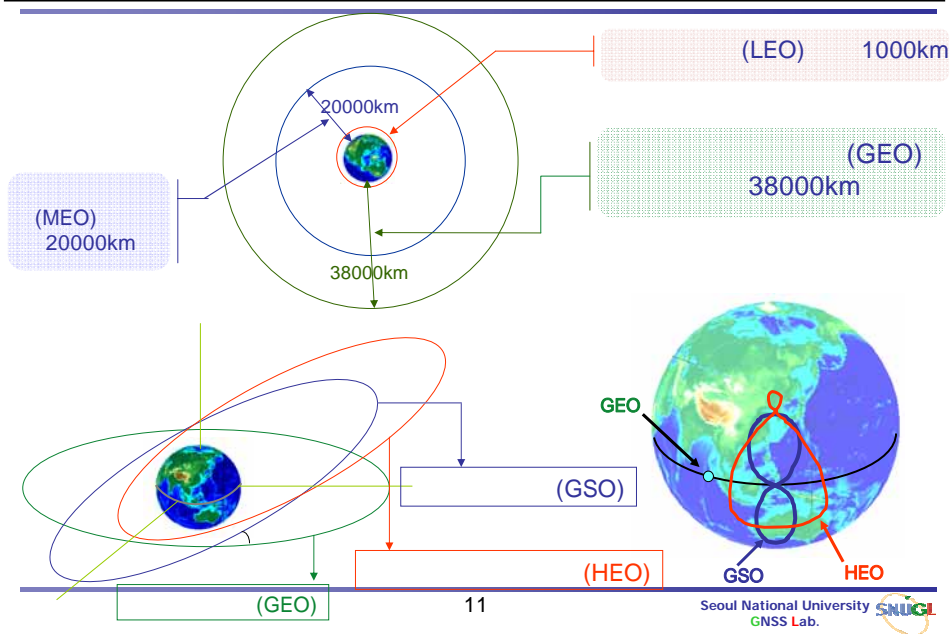
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Real time position in Google Earth

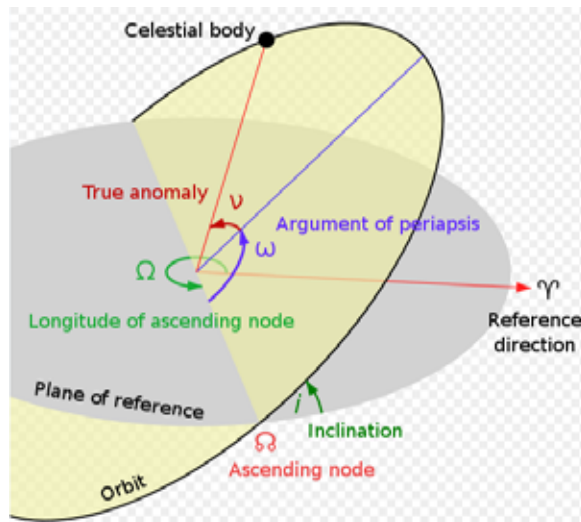


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Orbit type



Keplarian Element



Orbit type

(Low Earth Orbit)

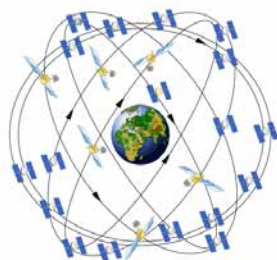
- : 500~1500km(Van allen)
- : 90~120 min
- (inclination angle) 0~90 90 가
- 가



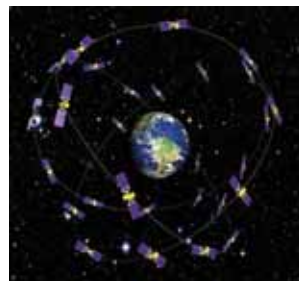
Orbit type

(Medium Earth orbit)

- : 5000~15000km(LEO)
- : 2~24
- Van allen (1500~5000km , 15,000~30,000km)
- (GPS, Glonass, Galileo)



GPS



Galileo System

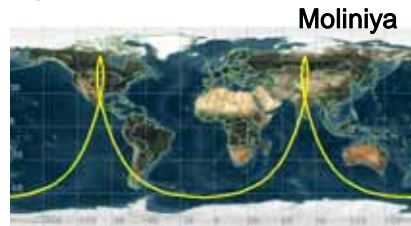
Orbit type

(Highly elliptical orbit)

- low-altitude perigee and an extremely high-altitude apogee
- Van allen
- ,
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Molniya



Molniya



Sirius

Orbit type

(Geostationary orbit)

- (inclination angle : 0 deg)
- : 24hr
- (eccentricity) 0 ,
- : 35,786km.
- , , SBAS(GNSS) .



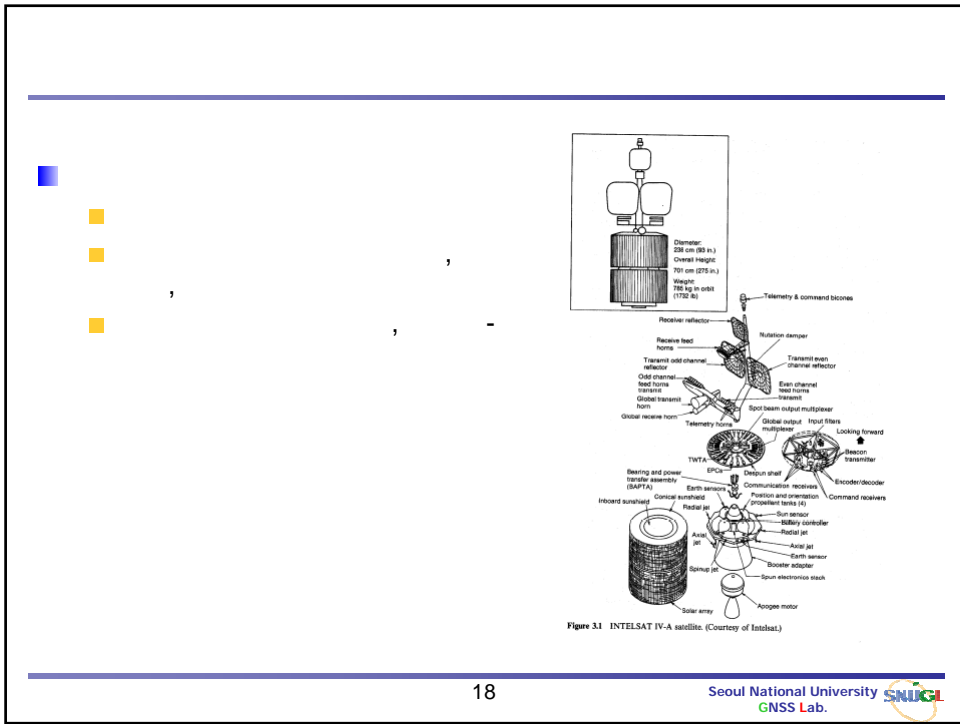
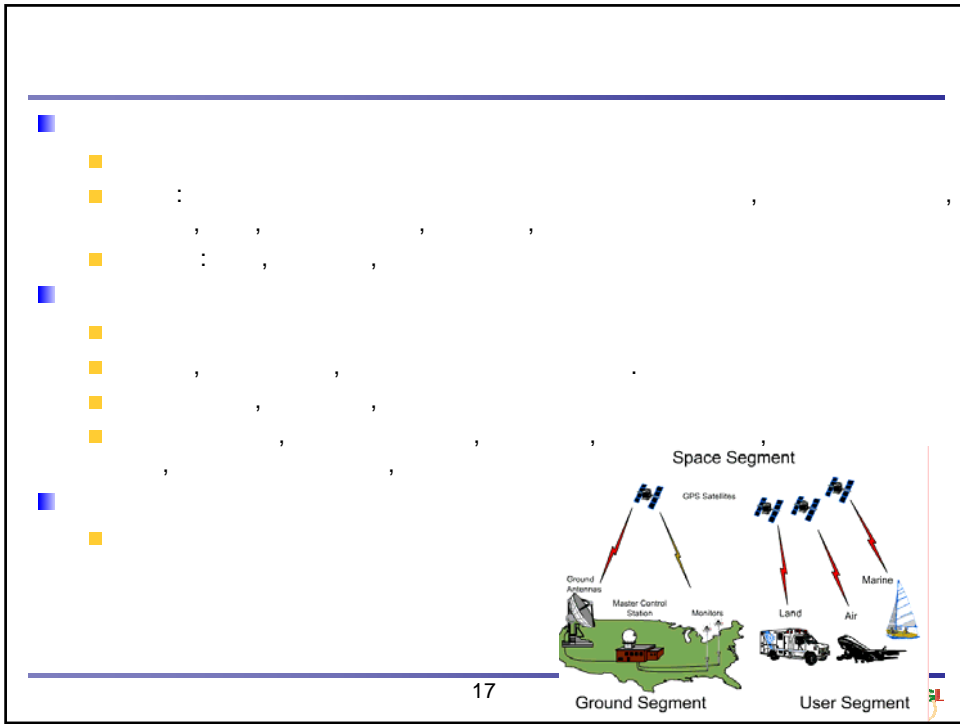


Figure 31 INTELSAT IV-A satellite. (Courtesy of Intelsat.)

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■ : 90~600km , 가

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■ -70 ~80

■ :가 .1%

■ : (Albedo)


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First launch by country

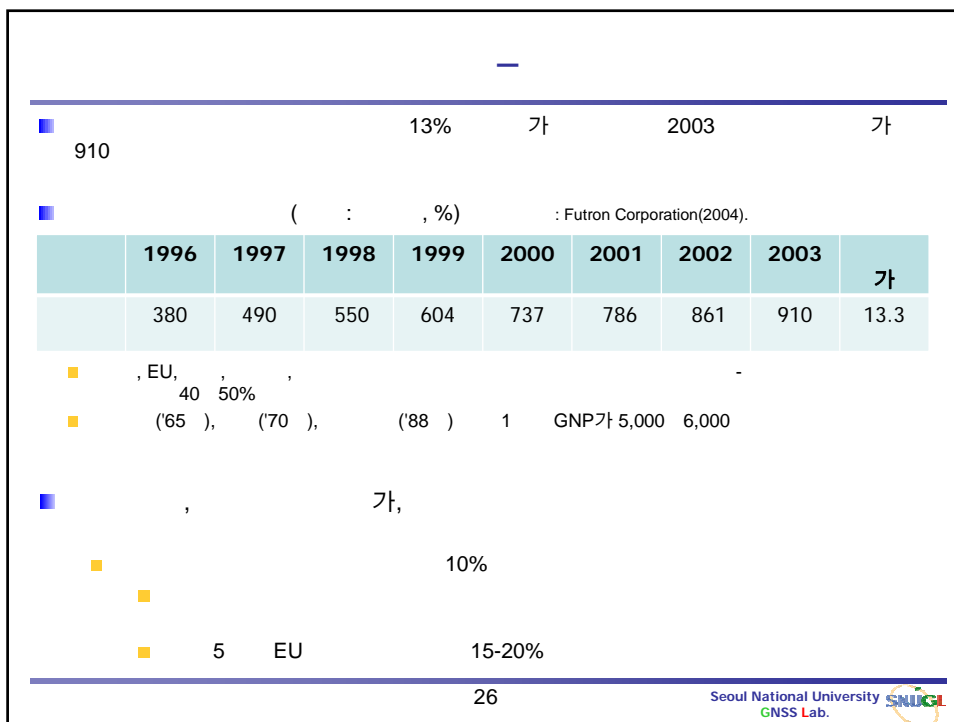
| Order | Country | Year of first launch | Rocket | Satellite |
|-------|--|----------------------|--------------|-----------------------------|
| 1 |  Soviet Union | 1957 | Sputnik-PS | <i>Sputnik 1</i> |
| 2 |  United States | 1958 | Juno I | <i>Explorer 1</i> |
| 3 |  Canada | 1962 | Thor-Agena | <i>Alouette 1</i> |
| 4 |  France | 1965 | Diamant | <i>Astérix</i> |
| 5 |  Japan | 1970 | Lambda-4S | <i>Ōsumi</i> |
| 6 |  China | 1970 | Long March 1 | <i>Dong Fang Hong 1</i> |
| 7 |  United Kingdom | 1971 | Black Arrow | <i>Prospero X-3</i> |
| 8 |  India | 1980 | SLV | <i>Rohini</i> |
| 9 |  Israel | 1988 | Shavit | <i>Ofeq 1</i> |
| — |  Russia ^[1] | 1992 | Soyuz-U | <i>Kosmos-2175</i> |
| — |  Ukraine ^[1] | 1992 | Tsyklon-3 | <i>Strela (x3, Russian)</i> |
| 10 |  Iran | 2009 | Safir-2 | <i>Omid</i> |

First launch by country including help of other parties¹⁾

| Country | Year of first launch | First satellite | Payloads in orbit in 2000 ²⁾ |
|---------------------|----------------------|------------------------------|---|
| Soviet Union (1962) | 1967 | Sputnik 1 | 1,390 |
| United States | 1968 | Explorer 1 | 1,042 |
| Canada | 1962 | Alouette 1 | 25 |
| Italy | 1964 | San Marco 1 | 14 |
| France | 1965 | Astérix | 44 |
| Australia | 1967 | WRESAT | 11 |
| Germany | 1969 | Absat | 27 |
| Japan | 1970 | Osumi | 111 |
| China | 1970 | Zhong Feng Hong 1 | 54 |
| United Kingdom | 1971 | Prosper 1-2 | 25 |
| Poland | 1973 | Interkosmos Wisniewski 300 1 | 1 |
| Netherlands | 1974 | AND | 5 |
| Spain | 1974 | Indagat | 9 |
| India | 1975 | Aryabhata | 34 |
| Indonesia | 1976 | Pelita A1 | 10 |
| Czechoslovakia | 1978 | Magnum 1 | 5 |
| Bulgaria | 1981 | Interkosmos Bulgaria 1000 | 1 |
| Brazil | 1985 | Shakti A1 | 11 |
| Mexico | 1985 | Monterrey 1 | 7 |
| Sweden | 1986 | Sveleg | 11 |
| Israel | 1988 | Ofer 1 | 7 |
| Luxembourg | 1988 | Astra 1A | 15 |
| Argentina | 1990 | Luzaf | 10 |
| Pakistan | 1990 | Bahar 1 | 5 |
| South Korea | 1992 | Araon 1 | 10 |
| Portugal | 1993 | Alentejo 1 | 1 |
| Thailand | 1993 | Titanos 1 | 8 |
| Turkey | 1994 | TurkSat 1B | 5 |
| Ukraine | 1995 | Sich-1 | 6 |
| Chile | 1995 | AFSAT-1A | 1 |
| Malaysia | 1996 | ANGSAT | 4 |
| Norway | 1997 | Thor 2 | 3 |
| Philippines | 1997 | MAPUPA 1 | 2 |

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- '92 '93 「 1 , 2 」 '93
「 1 , 2 」
- '95 , '96 , '99 . 「 1 , 2, 3 」
- '99 3 '03 1 1 2

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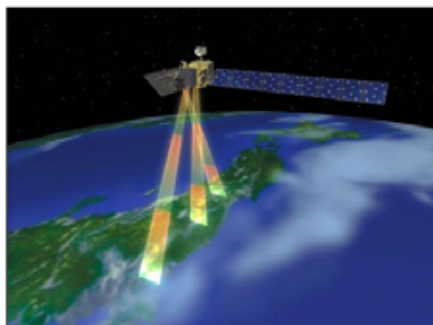
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-Global positioning system



GPS Block III



- **Satellite Broadcasting system**
- **24 satellite + 6 spare sat.**
- **At least 4 satellites needed for 3D calculation.**
- **Car Navigation, Personal Navigation, Avionics, Survey, etc...**
- **Accuracy(L1, C/A code, CEP, 50% probable)**

| | Standalone | DGPS |
|------------|------------|------|
| Horizontal | 10m | 1m |
| Vertical | 50m | 5m |

– Galileo system



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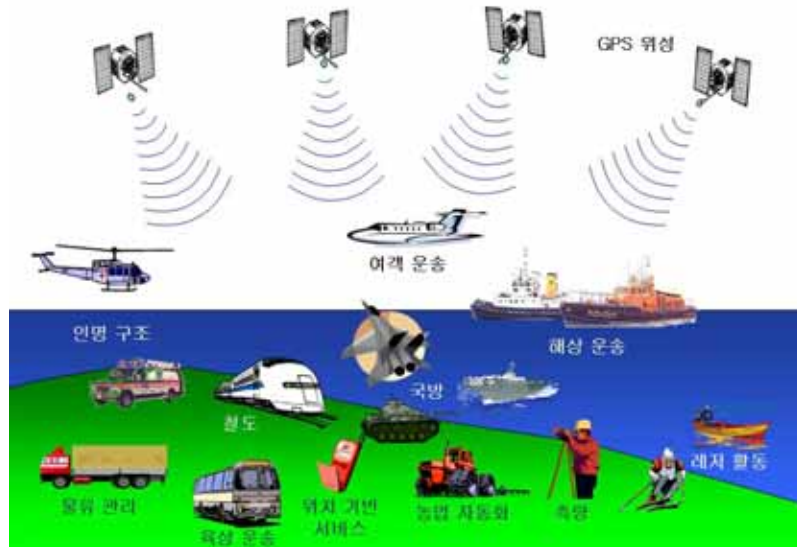
– Galileo system

- ◆ European Global Navigation Satellite System
- ◆ Highly accurate & guaranteed global positioning service under civilian control
- ◆ Inter-operable with GPS and GLONASS
- ◆ 30 satellites (27 operational + 3 spares)
- ◆ 3 circular Medium Earth Orbit
- ◆ Semi-major axis : 29601.3km
- ◆ Inclination angle : 56 degree
- ◆ Good coverage : ± 75 degree

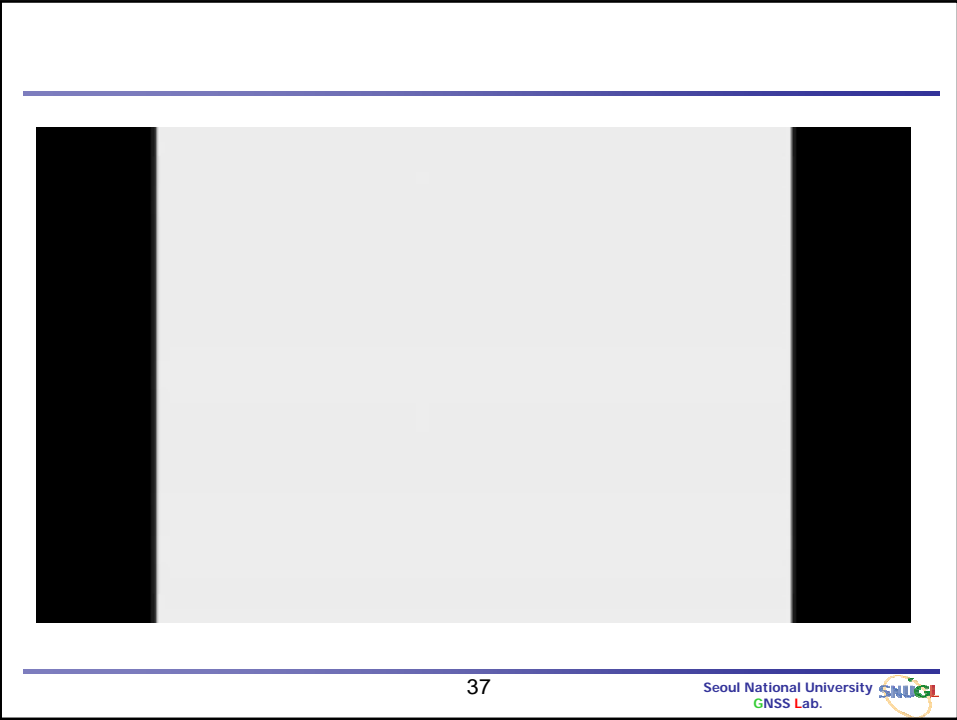


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GNSS



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Satellite (GMPCS) Global Mobile Personal Communications by
– Iridium, Globalstar, ICO ()
- Celestri(Motorola) – Teledesic(Microsoft) , Spaceway(Hughes) ,



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