

ASIASAT

Reaching Further, Bringing You Closer

4K 衛星傳播, 亞洲衛星的嘗試

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Manager, Sales Solutions

31 Oct 2015



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- Brief Introduction of AsiaSat
- Hands-on Satellite Transmission
- Our Engagement with UHD
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- AsiaSat UHD Platform
- Conclusions

ASIASAT

Brief Introduction of AsiaSat

Our Background

Our Satellite Fleet

Our Facilities

Our People

Reaching Further, Bringing You Closer

AsiaSat Corporate Video

ASIASAT

Our Background

Head-quartered in Hong Kong

Established in 1988

Listing in Hong Kong Stock Exchange

Regional Satellite Operator

- Asia's leading satellite operator, aiming to provide highest quality satellite communications services in the region

Coverage

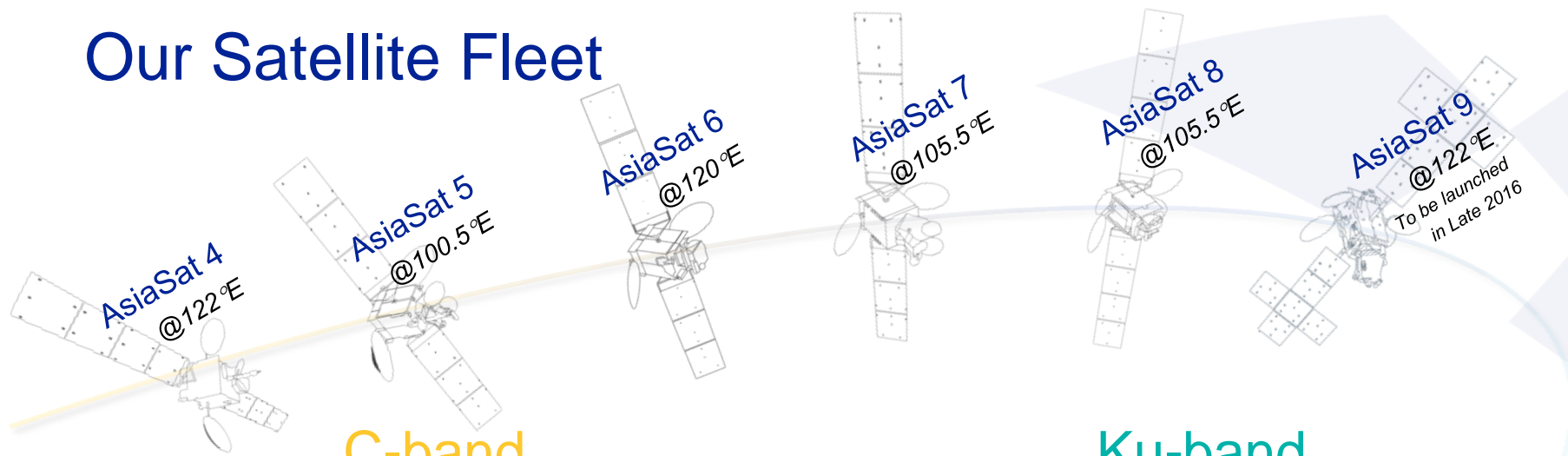
- Across 50 countries in Asia-Pacific
- Reaching 2/3 of world's population

Customer Profile

- International and Regional TV Broadcasters
- Telecommunications Service Providers
- News Agencies
- Corporations and Governments

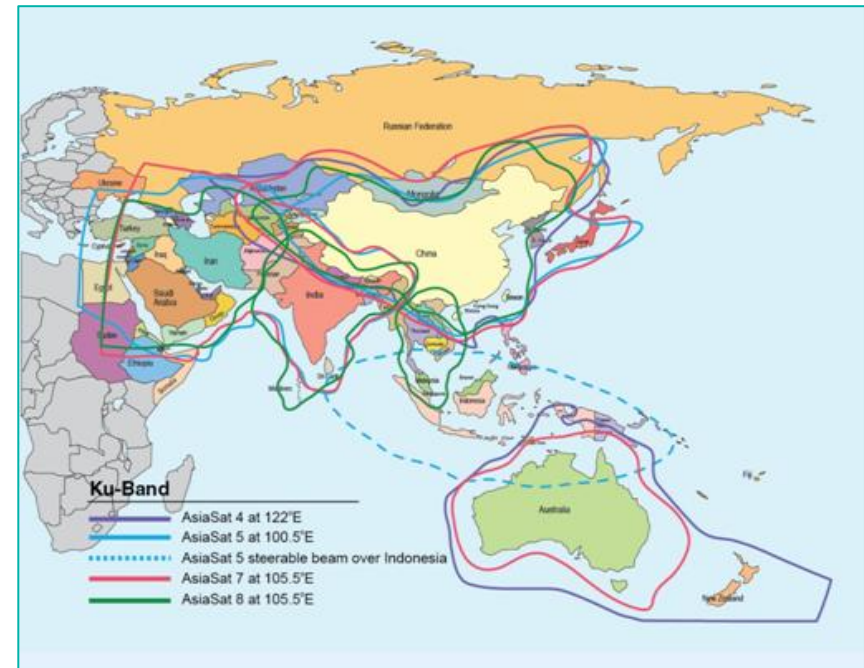
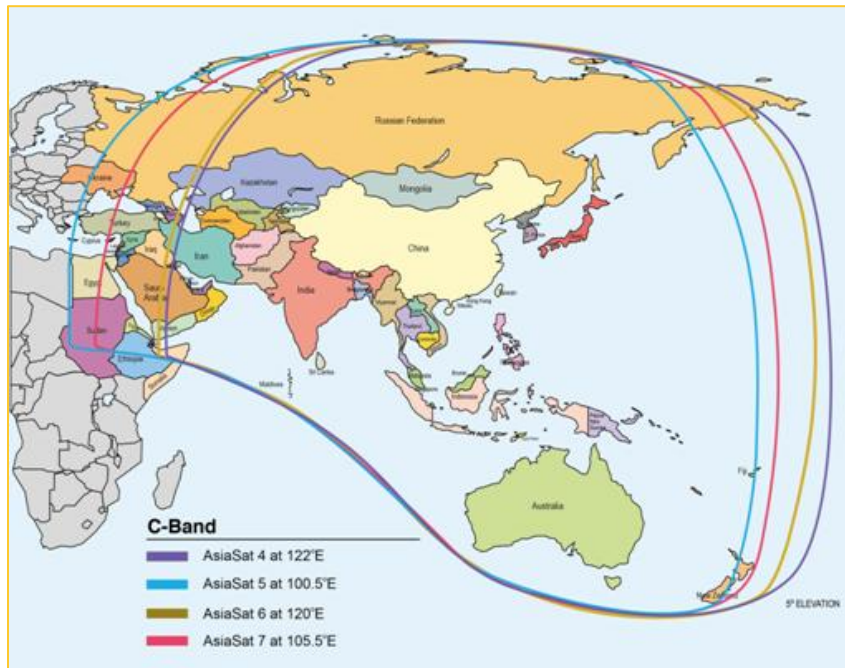


Our Satellite Fleet



C-band

Ku-band



For more details of our satellite fleet, please visit our web site (<http://www.asiasat.com/technology/satellite-fleet>).

Our Earth Stations

Tai Po Earth Station



Stanley Earth Station



Our People



Meet Our People

We have over 130 staff in our organisation.

We are all committed to support Customer success in satellite transmission as Customer's success is our success.

- Ever Better | Insightful | Partnering | Dependable | Committed

Please visit to our web site (<http://www.asiasat.com/aboutus/meet-our-people>) for more about our staff interesting stories.



Paul CHAN

CK YU



Sara CHEUNG

Monica CHENG



Alison YEUNG

Fred HO



Preston LAI

Alan WONG



Paulus CHAU



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Hands-on Satellite Transmission

Reaching Further, Bringing You Closer

Where are the Satellites?

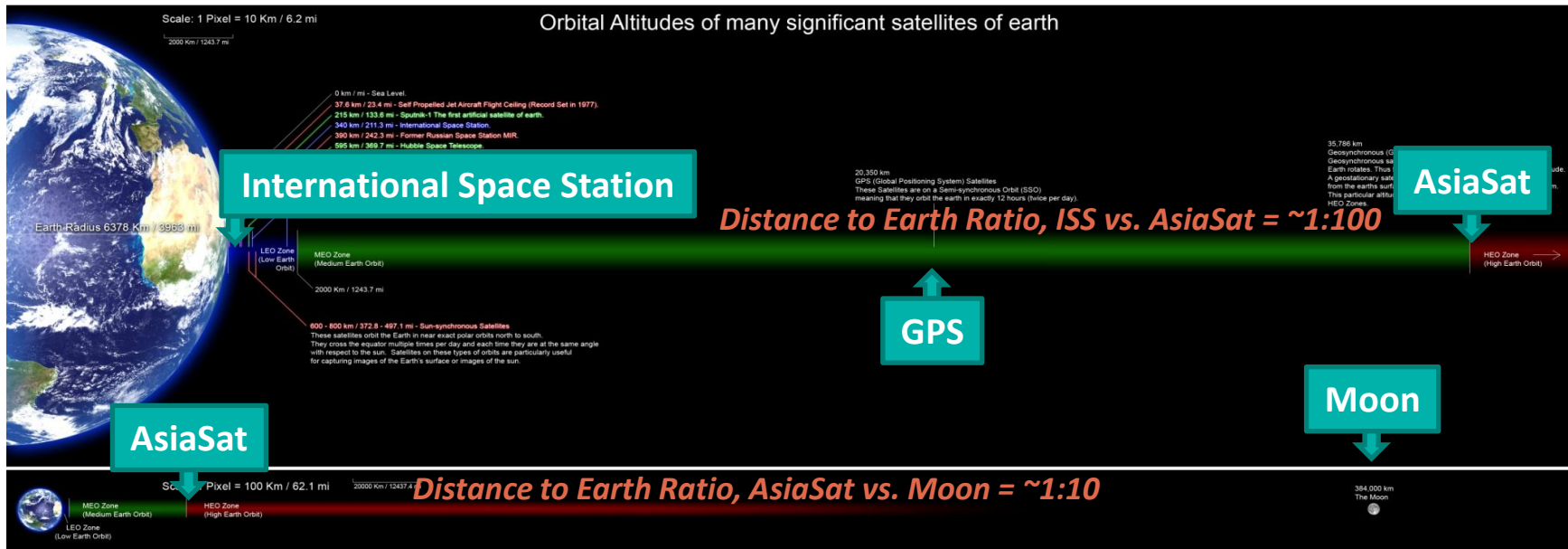
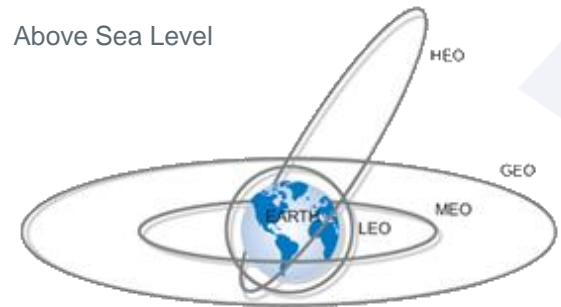
International Space Station (ISS): 340km

GPS Satellites: 20,350km

AsiaSat (Geostationary Satellites): 35,786km

Moon: ~384,000km

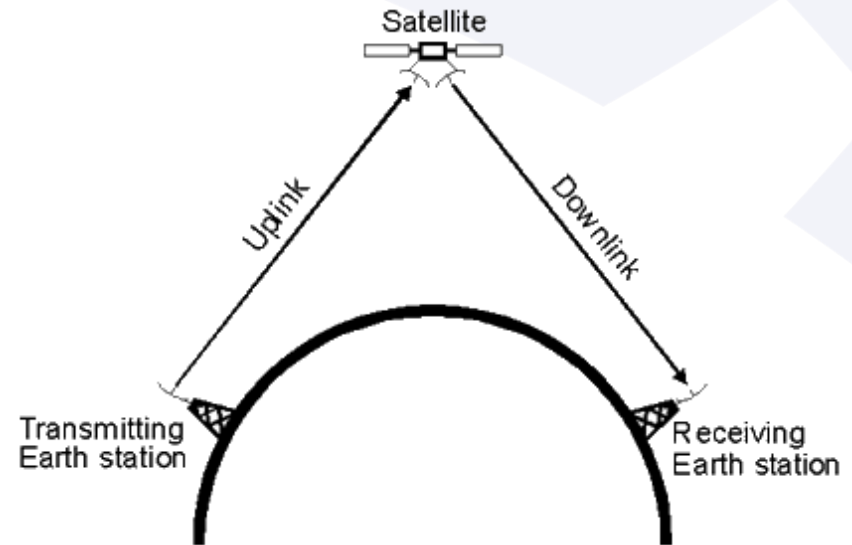
Above Sea Level



Source: <http://commons.wikimedia.org/wiki/File:Orbitalaltitudes.jpg>

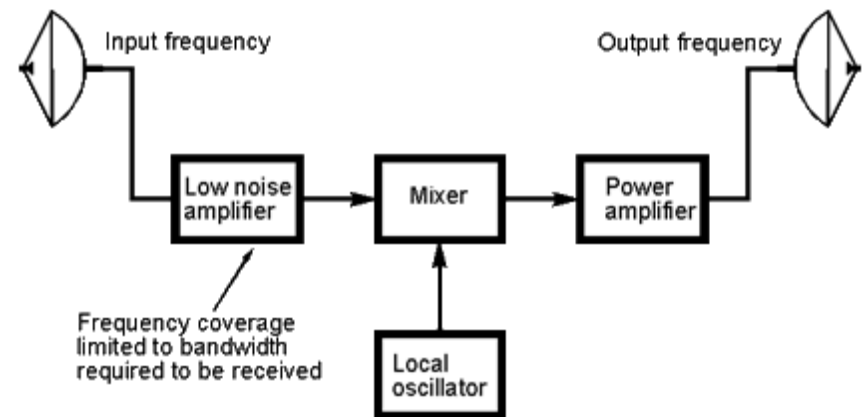
How does Satellite Transmission work?

1. Tx Earth Station sends SIGNAL (Uplink)
2. Satellite receive and retransmit the SIGNAL
3. Rx Earth Station to receive SIGNAL (Downlink)
4. Using different frequency bands for Uplink and Downlink



Frequency Bands

- L-band: 1 to 2 GHz
- S-band: 2 to 4 GHz
- **C-band: 4 to 8 GHz**
- X-band: 8 to 12 GHz
- **Ku-band: 12 to 18 GHz**
- K-band: 18 to 27 GHz
- Ka-band: 27 to 40 GHz

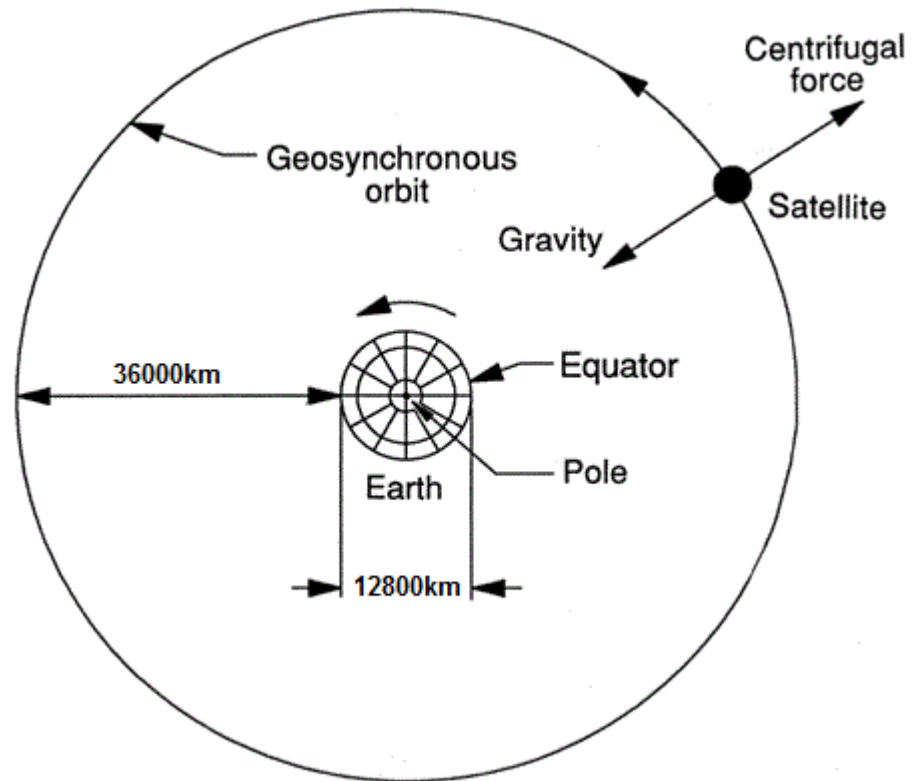


Satellite Transponder block diagram

How does Satellite stay in orbit?

Satellite stays in orbit due to the balance of two factors

- Angular Velocity
- Gravitational Pull between the Earth and the Satellite

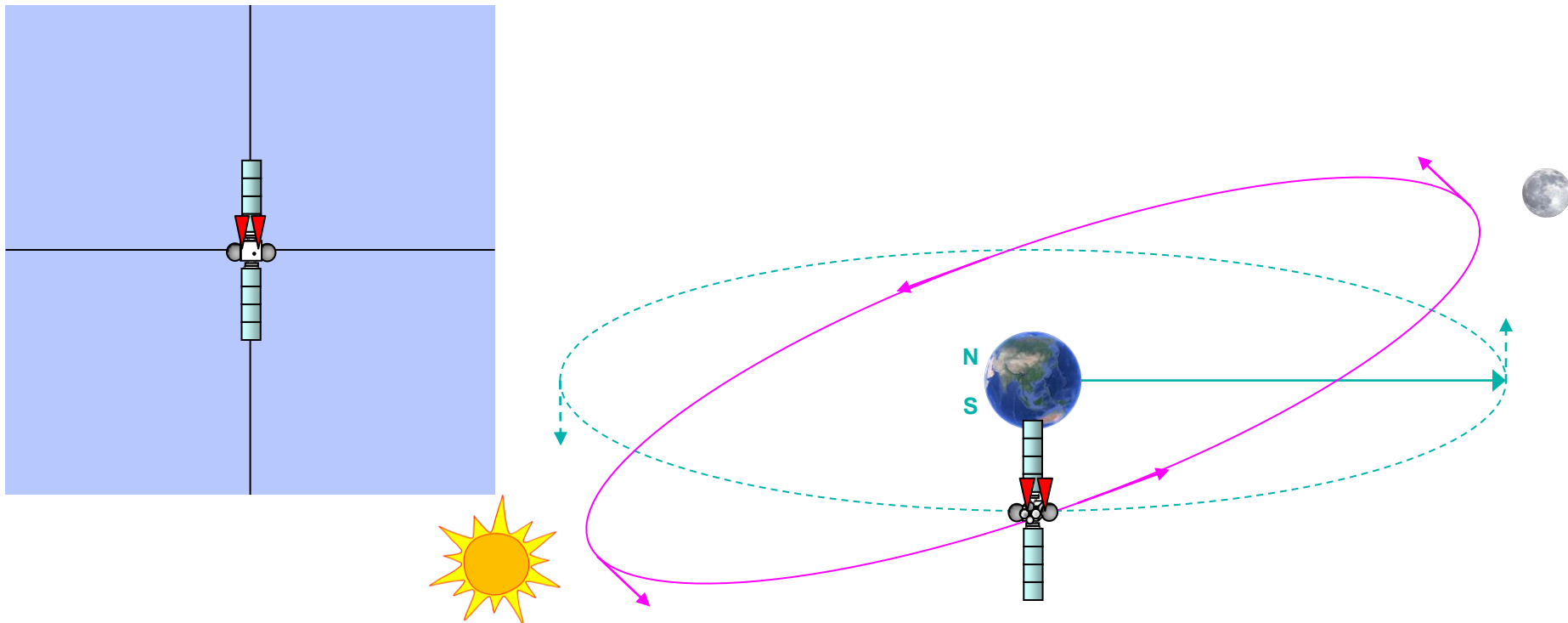


Does Satellite keep where they are Forever?

Forces act on satellite to change its orbit over time

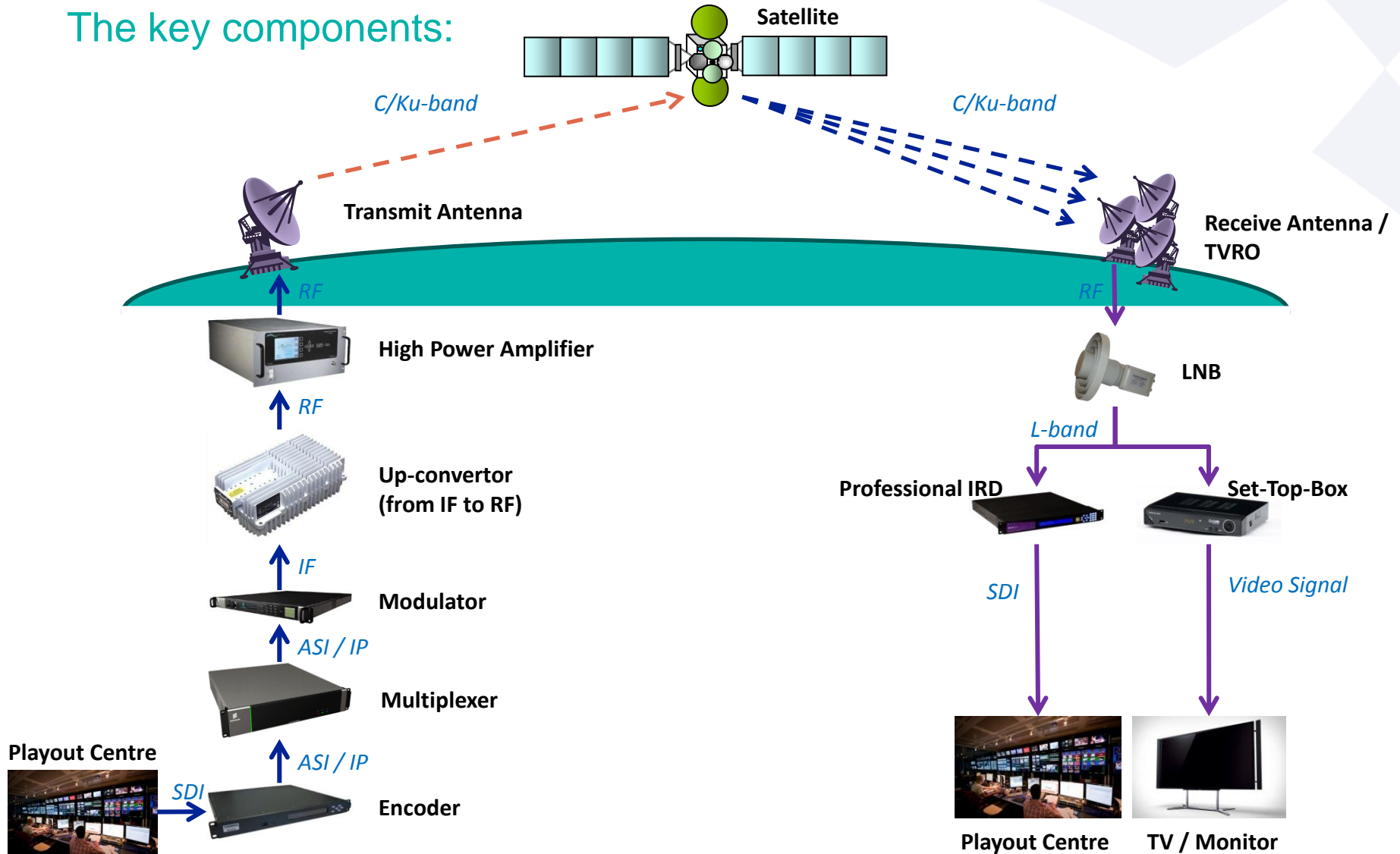
- Gravitational Pull from Sun & Moon
- Slight Asymmetries in Earth's Gravitational Field
- Solar Radiation Pressure

NO!



How to Broadcast a TV Signal through Satellite?

The key components:

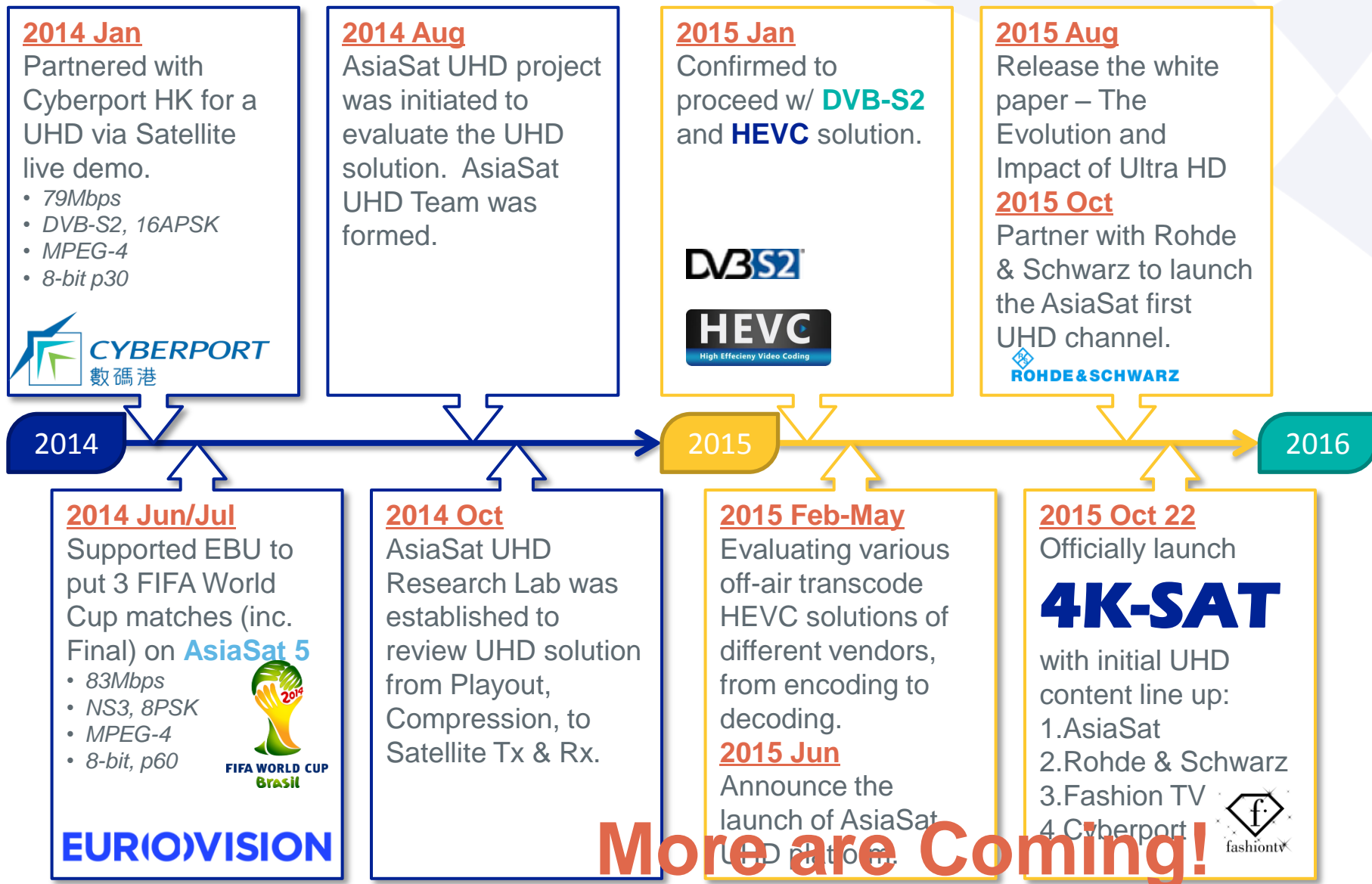


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Our Engagement with UHD

Reaching Further, Bringing You Closer

What have we done?



AsiaSat UHD Demo with Cyberport HK (23 Jan 2014)

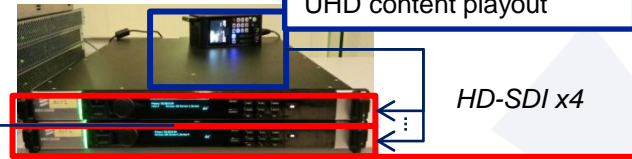
**AsiaSat 3S
@105.5E**



AsiaSat Uplink System



**DVB-S2
Modulator**



**Playback System
UHD content payout**

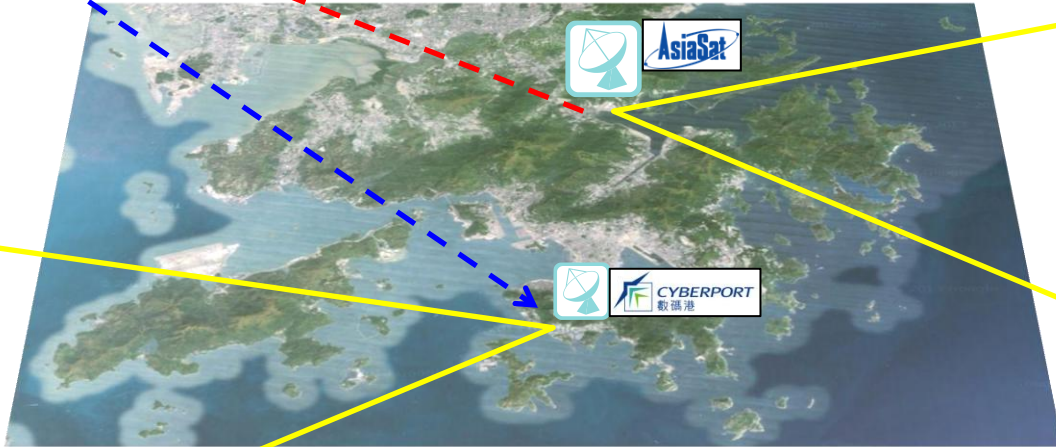
HD-SDI x4

**Encoders x2 (2x2 HD-SDI interfaces)
for compressing the UHD content**

78Mbps
MPEG-4
8-bit p30

Transmission Parameters

- Downlink Frequency:** 4100MHz
- Downlink Polarisation:** V-pol
- Symbol Rate:** 30MSps
- Data Rate:** 79.11Mbps
- Type:** DVB-S2
- Modulation:** 16APSK
- FEC:** 2/3



Professional IRD x4



Cyberport TVRO



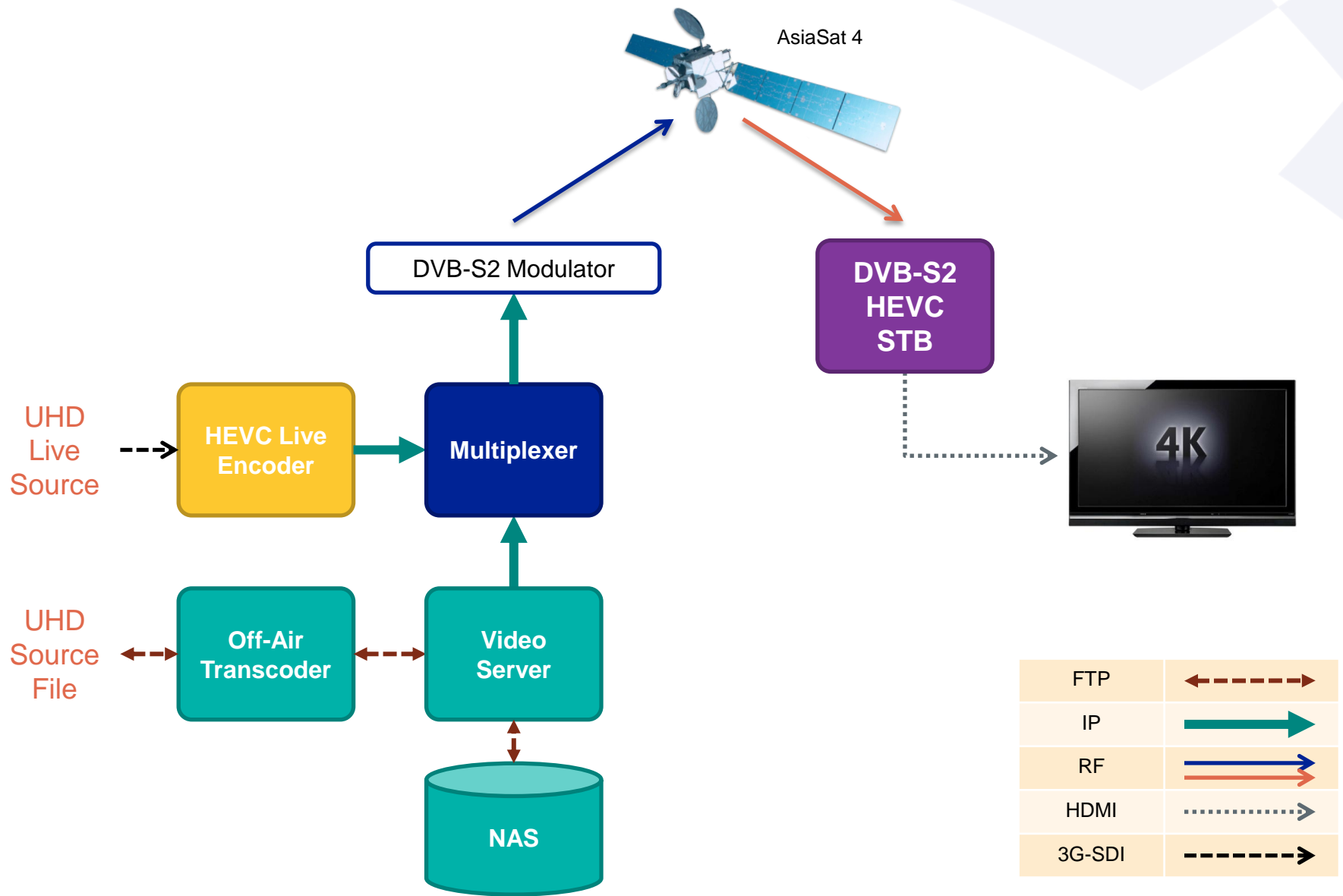
**HD-SDI to HDMI
Converter**



84" UHD TV in Cyberport MCC



HEVC Solution for UHD Broadcast



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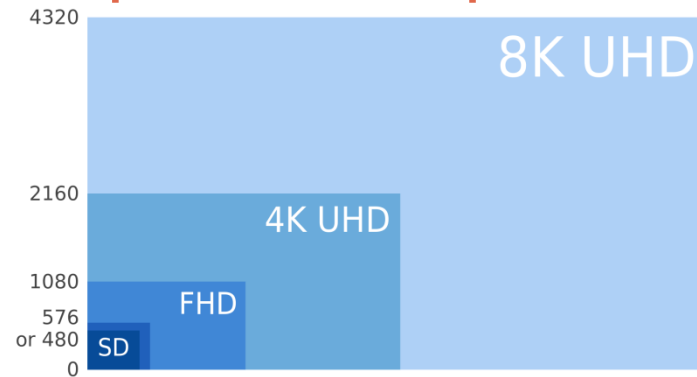
How we see UHD?

Reaching Further, Bringing You Closer

Much Better Viewing Experience / Quality

It is a lot more than just pixels and pictures!

Higher Resolutions



Much Better Viewing Experience / Quality

It is a lot more than just pixels and pictures!

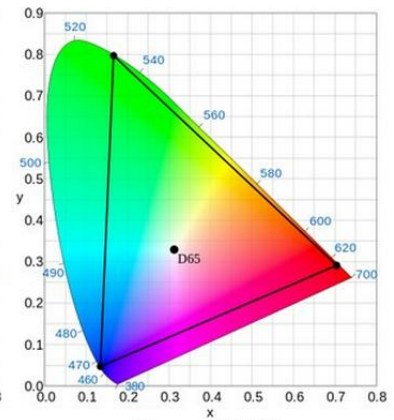
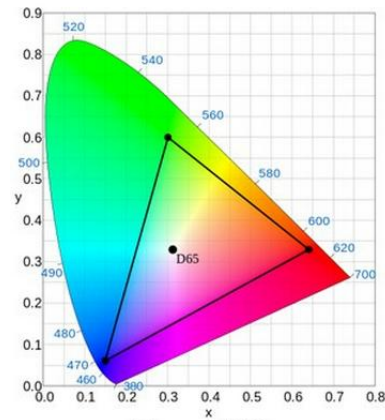
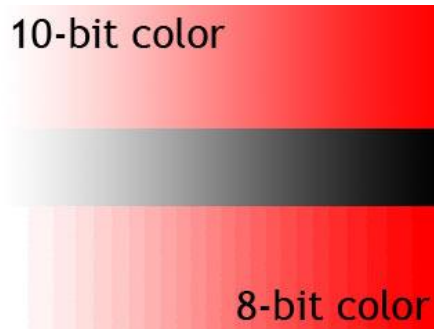
Higher Resolutions

Higher Colour Bit Depth

Uncompressed 10 Bit



10-bit color



8-bit video



10-bit video



Much Better Viewing Experience / Quality

It is a lot more than just pixels and pictures!

Higher Resolutions

Higher Colour Bit Depth

Higher Dynamic Range

Original images



-4 stops

-2 stops

+2 stops

+4 stops

Results after processing



Simple contrast reduction

Local tone mapping



1. Underexposed

2. "Properly" exposed

3. Overexposed

4. Final Product

Much Better Viewing Experience / Quality

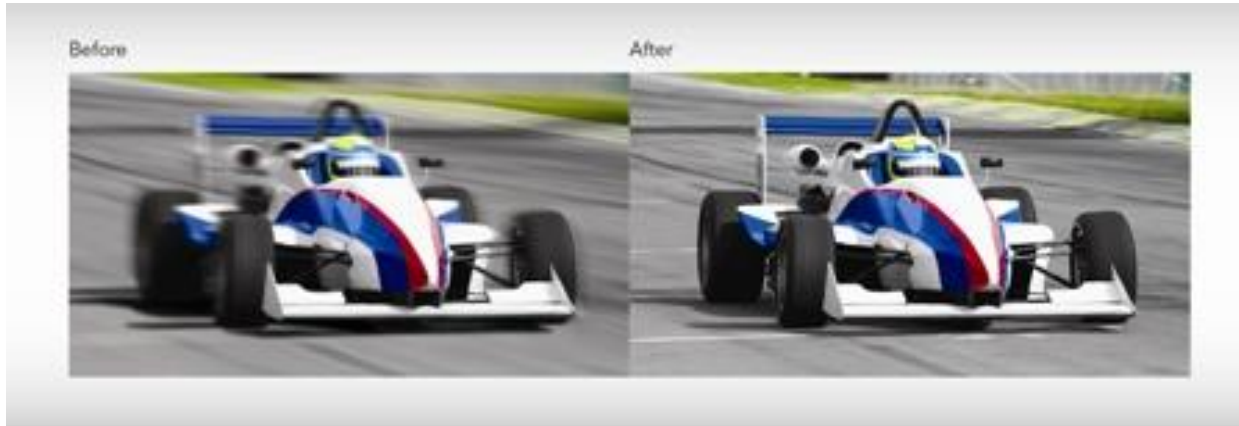
It is a lot more than just pixels and pictures!

Higher Resolutions

Higher Colour Bit Depth

Higher Dynamic Range

Higher Frame Rate



Much Better Viewing Experience / Quality

It is a lot more than just pixels and pictures!

Higher Resolutions

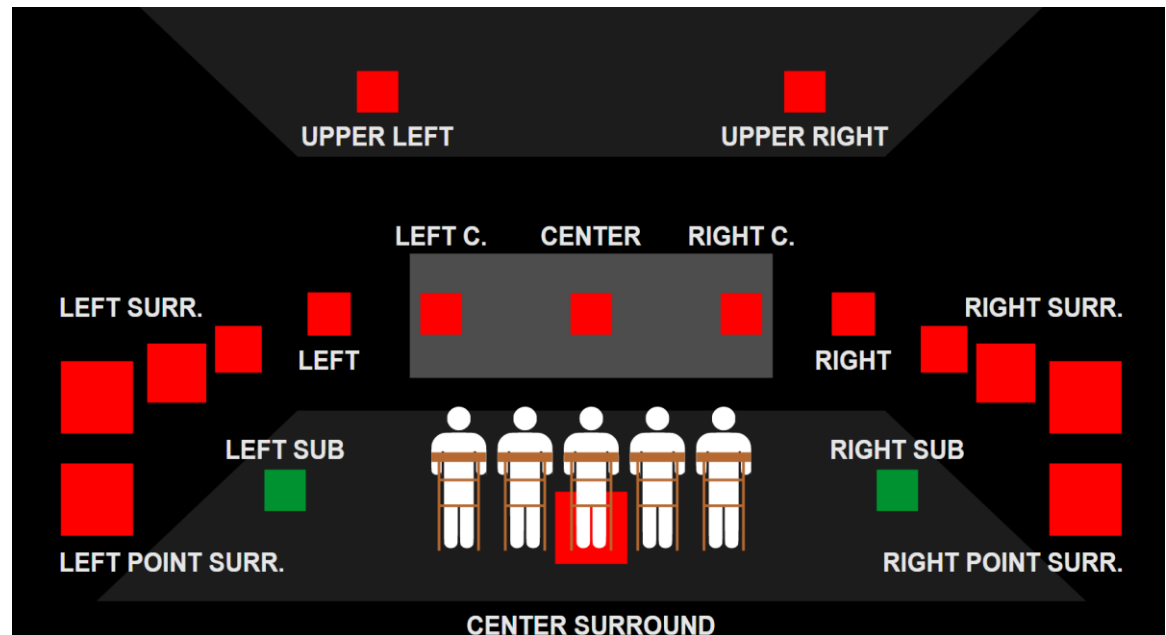
Higher Colour Bit Depth

Higher Dynamic Range

Higher Frame Rate

Significantly Enhanced Audio System

- 16.2
- 22.2



UHD Standards & Roadmap

Category	UHD-1 Phase 1	UHD-1 Phase 2	UHD-2
Deployment	2015	2018	2020
Resolution	3840x2160	3840x2160	7680x4320
Frame Rate	p50 / p60	p100 / p120	p100 / p120
Dynamic Range	HDR preferred	HDR mandatory	HDR mandatory
Colour Space	Rec.709	Rec.709 or Rec.2020	Rec.2020
Colour Sampling	4:2:0 / 4:2:2	4:2:0 / 4:2:2	4:2:0 / 4:2:2 / 4:4:4
Colour Bit Depth	10 bits	10 / 12 bits	10 / 12 / 14 bits
Video Encoding	HEVC Main 10	HEVC Main 10	HEVC Main 10
Audio Format	5.1	Beyond 5.1	Object Based
Audio Codec	Open	TBD	Next Generation Audio Codec
Viewing Angle	66 degrees	66 degrees	100 degrees
Viewing Distance	1.5H	1.5H	0.75H

UHD-1 Phase 1

UHD-1 Phase 2




UHD-2



Requirements for Efficient UHD Satellite Transmission

Higher Satellite Throughput

Satellite Transmission Technology

DVB-S (1993) 
 DVB-S2 (2003) 
 DVB-S2X (2014) 

To Utilize the Spectrum Efficiently

Improvement in roll-off

New Enhanced Modulation & Coding Techniques

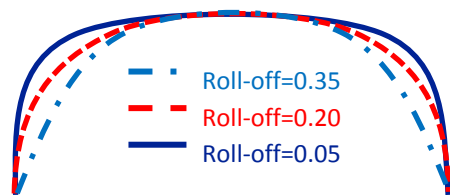
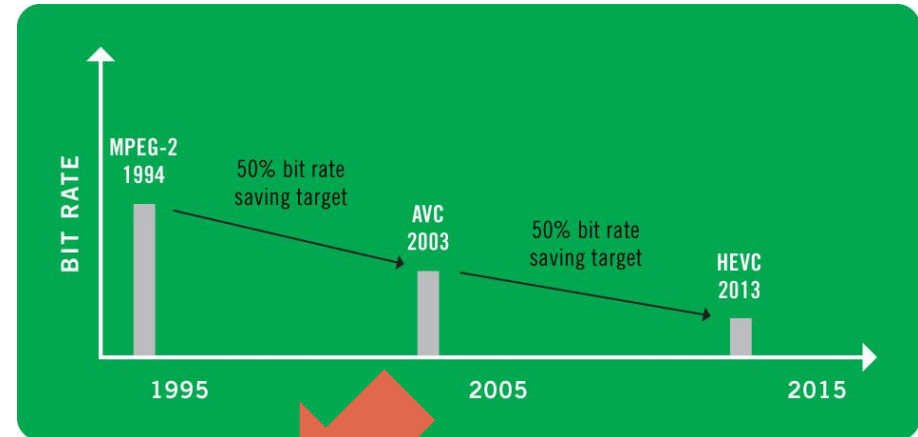
Advanced Compression Technology

Compression Technology

H.262 / MPEG-2 (1994)
 H.264 / MPEG-4 AVC (2003)
 H.265 / HEVC (2013)

Save the Bit Rate of a channel

	DVB-S	DVB-S2	DVB-S2X
Roll-off	35%	20%	5%
Modulation	QPSK	8PSK	16APSK
No. of Bits per Hz	2	3	4
Expected Throughput Improvement	-	Min. 30%-40%	Min. 30%-40%



More Bits per Hertz !
More Channels per Transponder !

Number of Channels per Transponder

Estimated Bit Rate (Mbps) ¹	Compression	SD (p25/p30)	HD (p25/p30)	UHD (p50/p60)
	H.262 / MPEG-2	3 – 5	-	-
	H.264 / MPEG-4 AVC	2 – 3	8 – 10	75 – 85
	H.265 / HEVC	-	4 – 5	15 – 25

Satellite Transmission ²	Carrier Data Rate	Target TVRO Size ³	SD (p25/p30)	HD (p25/p30)	UHD (p50/p60)
DVB-S QPSK FEC 3/4	38Mbps	2.4m+	7 – 12 channels in MPEG-2	4 – 5 channels in MPEG-4	-
DVB-S2 8PSK FEC 5/6	72Mbps	2.4m+	24+ channels in MPEG-4	7 – 9 channels in MPEG-4 14 – 18 channels in HEVC	2 – 5 channels in HEVC
DVB-S2 16APSK FEC 2/3	79Mbps	3m+	-	7 – 9 channels in MPEG-4 15 – 19 channels in HEVC	1 channel in MPEG-4 3 – 5 channels in HEVC
DVB-S2X 16APSK FEC 114/180	83Mbps	3m+	-	8 – 10 channels in MPEG-4 16 – 20 channels in HEVC	1 channel in MPEG-4 3 – 5 channels in HEVC
DVB-S2X 16APSK FEC 135/180	99Mbps	4m+	-	9 – 12 channels in MPEG-4 19 – 24 channels in HEVC	1 channel in MPEG-4 3 – 6 channels in HEVC

Assumptions:

1. Estimated Bit Rate range is for reference only.
2. Symbol Rate: 27.5MSps (DVB-S, 35% roll off); 30.0MSps (DVB-S2, 20% roll off); 34.285MSps (DVB-S2X, 5% roll off)
3. TVRO size at beam centre region in C-band.

UHD Challenges

UHD Standards => high throughput requirement!

- Much more details (High Resolution & High Colour Space)
- Much better viewing experience (High Frame Rate & High DR)

Cost of making the UHD content, expensive!

- Limited UHD studios available
- UHD recording equipment, most are up to p25 only
- Editing at p50 or p60 takes a long time

Evolution of SDI

- UHD-SDI, Electrical or Optical Physical Layer?

UHD storage file format is to be finalized with HEVC enable

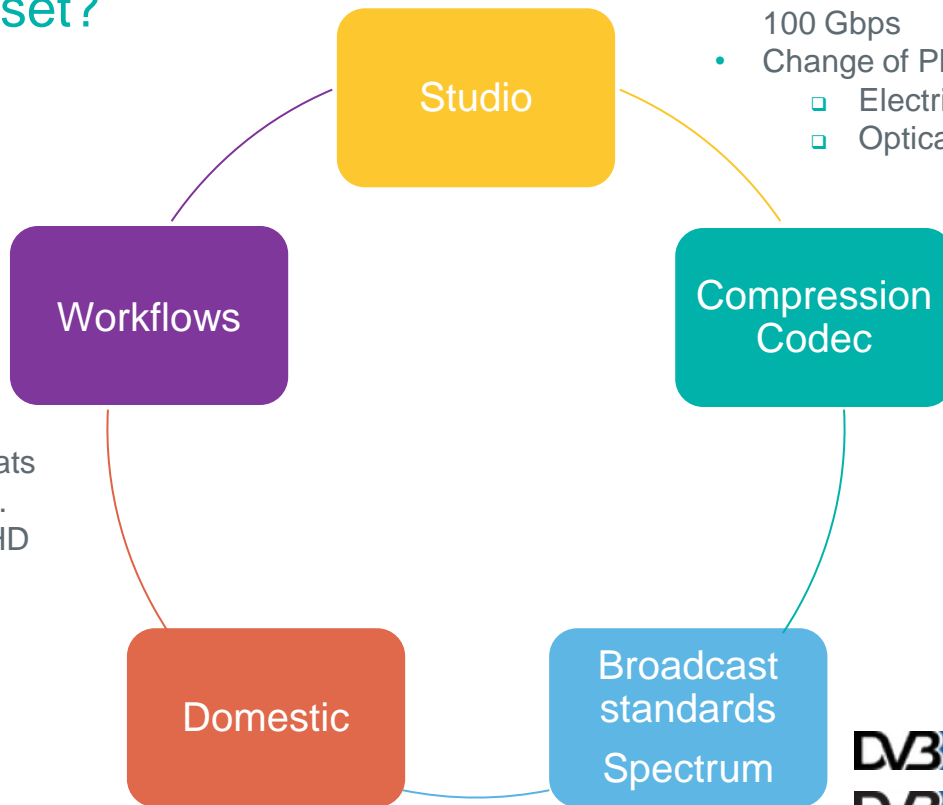
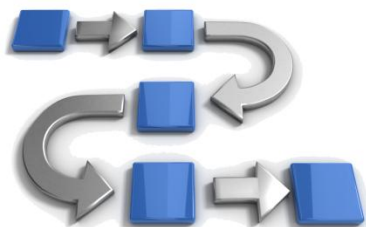
- The industry has not yet fixed the UHD source file format
- Aim at reducing storage size
- Existing formats are all in MPEG-4 compression
 - Apple ProRes 50mins UHD p60 clip need 700GB storage! (14GB/min)

Spectrum/Bandwidth limited in Terrestrial / Satellite

- Occupied by mobile applications

End to End UHD

What needs to be upgraded besides the TV set?



Studio Interconnection Standards

- HD p50 needs 3Gbps
- 3G-SDI cable support up to 3Gbps
- UHD 1 p60 needs 10.5 Gbps,
- 4x 3G-SDI for UHD 1 at p60
- UHD 2 will need multiple 10 Gbps or over 100 Gbps
- Change of Physical Layer for UHD?
 - Electrical (Coaxial or Ethernet) or
 - Optical (Multimode Fibre)



Video and Audio Codec Development

- The higher bitrate of UHD TV development needs increased performance from Codecs and compression algorithms



Broadcast standards

- UHD for Satellite, Cable, Terrestrial transmission and Internet connections.

Spectrum

- Spectrum is limited in Terrestrial / Satellite

Transitional workflows

- UHD & 4K production formats (ProRes, DPX, XAVC, etc.).
- Needs to support existing HD and UHD post production workflows and conversion.
- UHD Recording equipment

Domestic interconnection standards

- HDMI (ver. 1.4) => 4K p30
- HDMI (ver. 2.0) => UHD-1 p60



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AsiaSat UHD Platform

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AsiaSat UHD Platform

Satellite

- AsiaSat 4 @122 E

Transponder

- A4-C13H

Downlink Frequency

- 4120MHz

Downlink Polarization

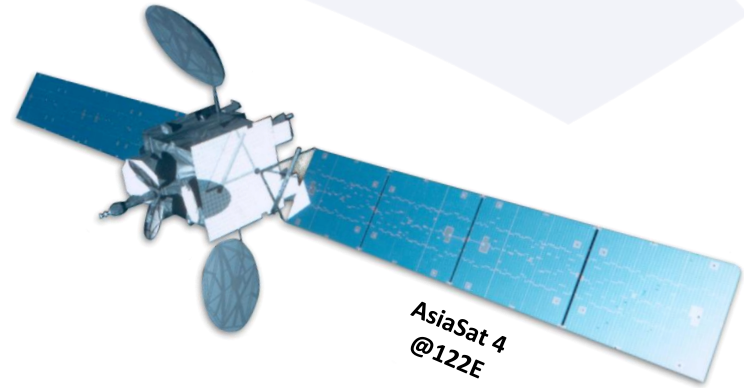
- Horizontal

Carrier Parameters

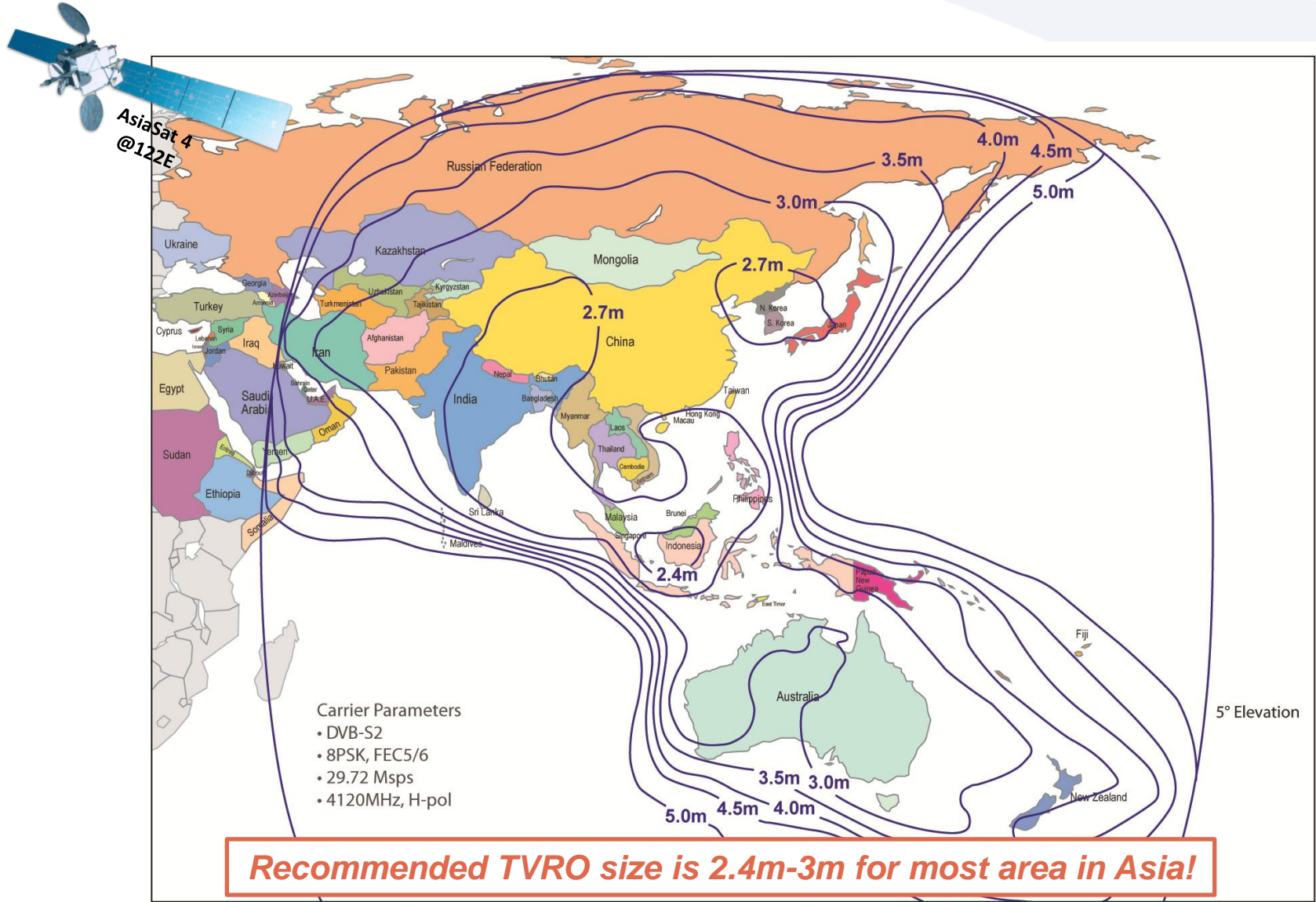
- DVB-S2
- 8PSK, FEC 5/6
- 29.72MSps

Max. Throughput

- 71.99Mbps
- for 3-5 UHD channels with HEVC compression



A4-C13H DVB-S2 MCPC Platform TVRO Map



V2/20-11-2015

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Conclusions

Reaching Further, Bringing You Closer

Conclusions

More UHD contents are required to push UHD broadcasting!

AsiaSat is the advocate for UHD broadcasting.

We are **READY** to support your UHD development in both Full Time and Occasional applications.

We give our best supports on both commercial and technical aspects on UHD trial via satellite.

- Please get in touch with our people for more details!

AsiaSat **4K-SAT**

ASIASAT

Reaching Further, Bringing You Closer

Thank You

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