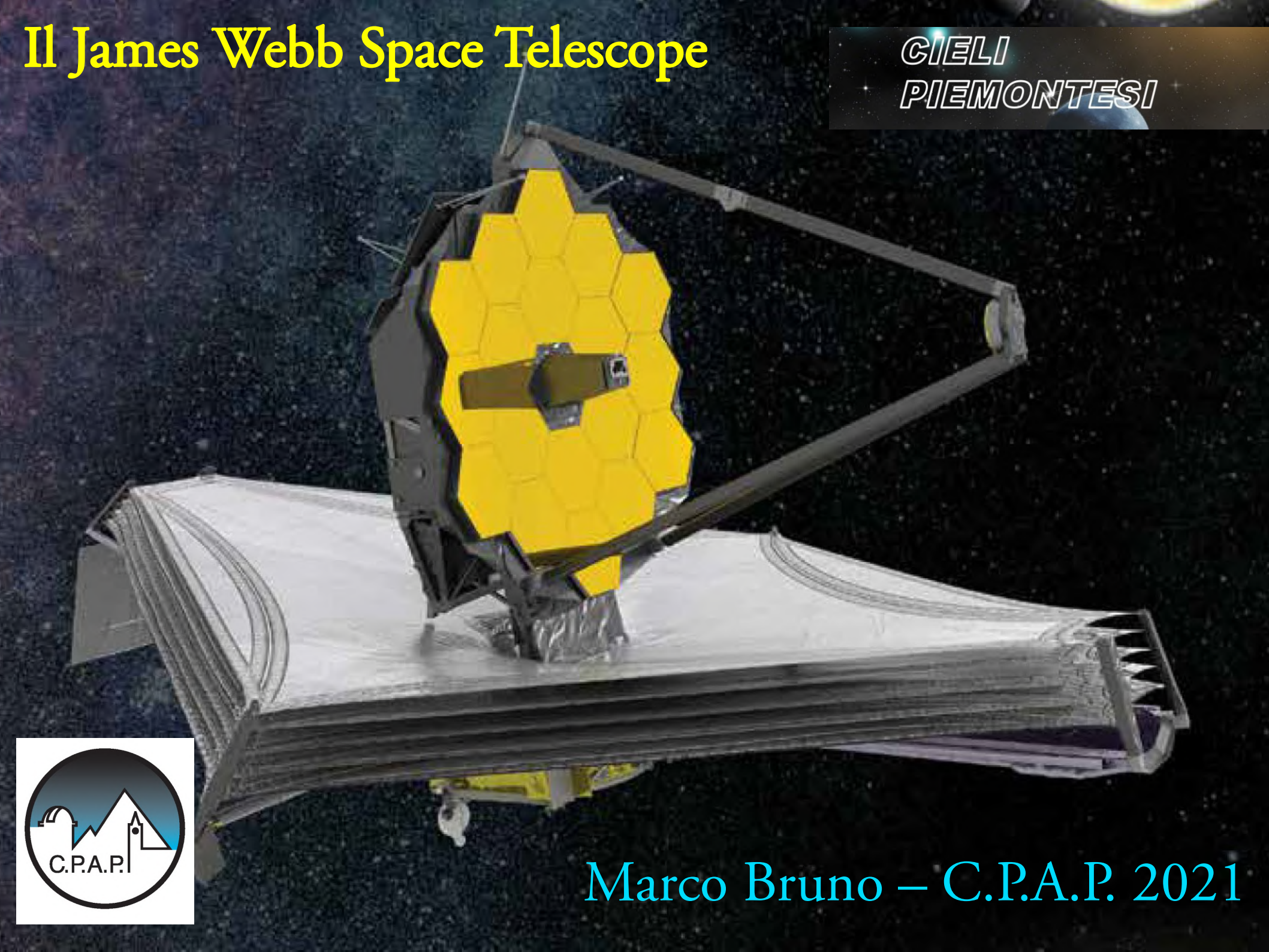
# Il James Webb Space Telescope

CIELI PIEMONTESI



C.P.A.P.

Marco Bruno – C.P.A.P. 2021

***James Webb Space telescope (JWST)***

Sviluppo iniziato nel 1996, 6 anni dopo il lancio di HST

Missione congiunta NASA/ESA/CSA

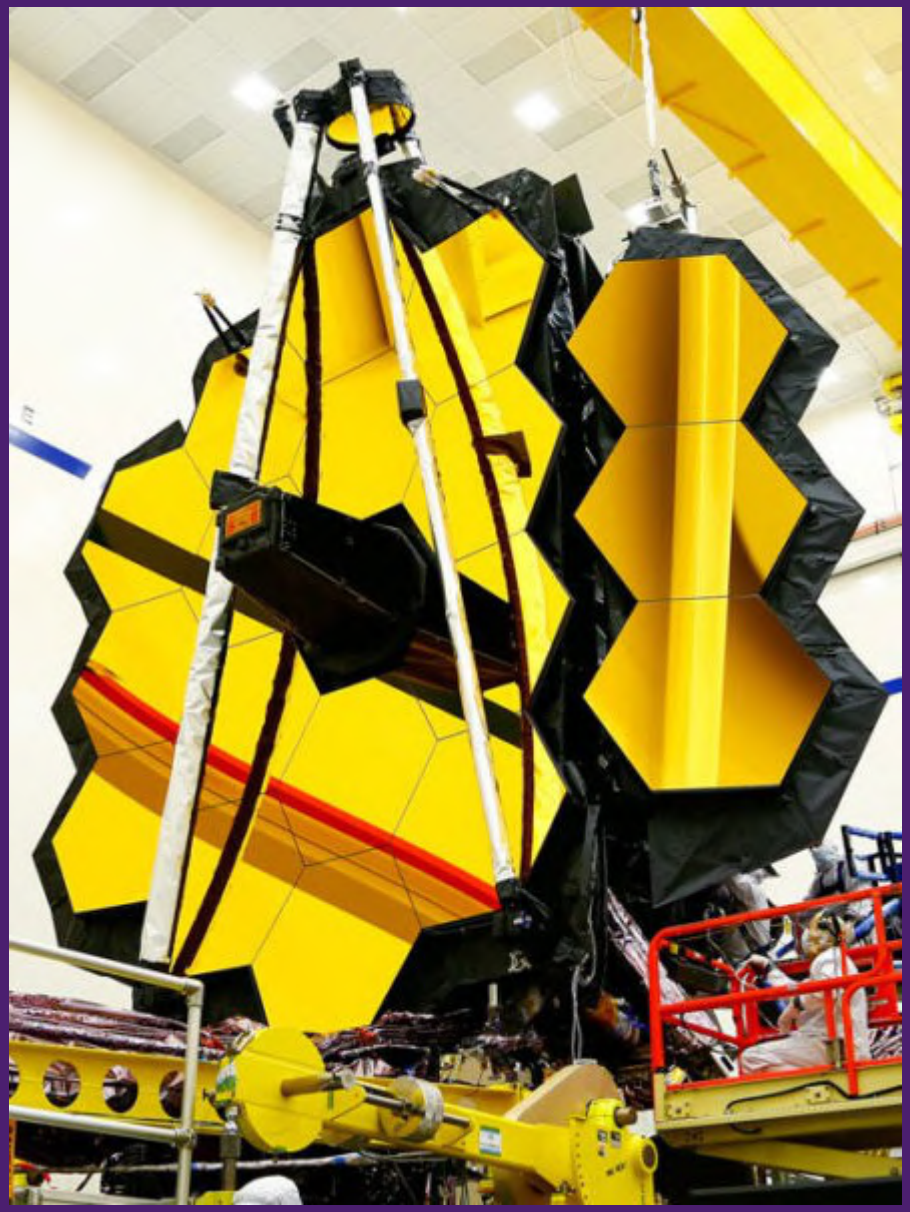
Banda dal visibile al medio IR (0,6 – 23 μm)
[HST: da 0,1 a 1 μm]

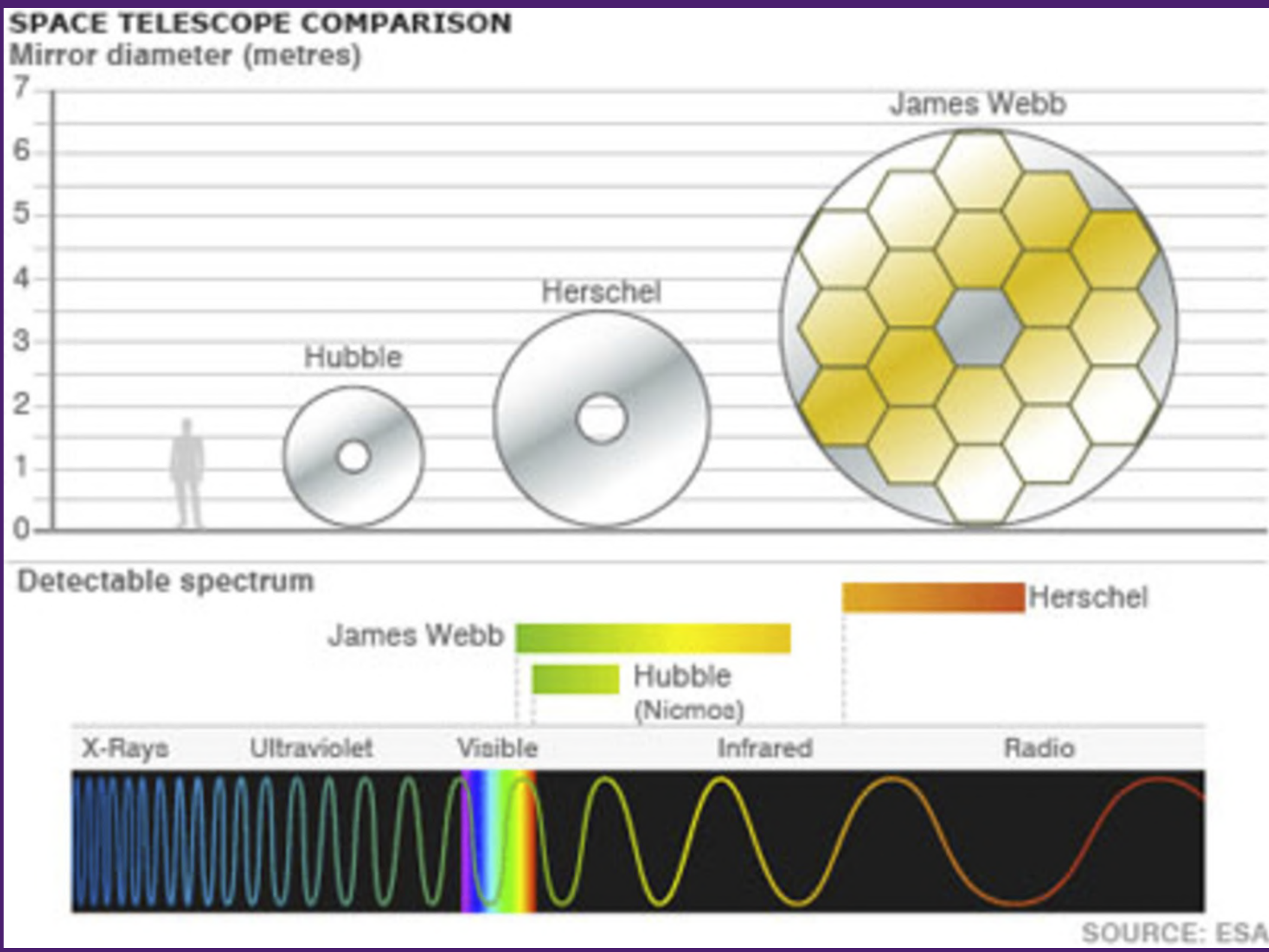
Lancio atteso nel 2007, budget 500 M$
Riprogetto parziale nel 2007

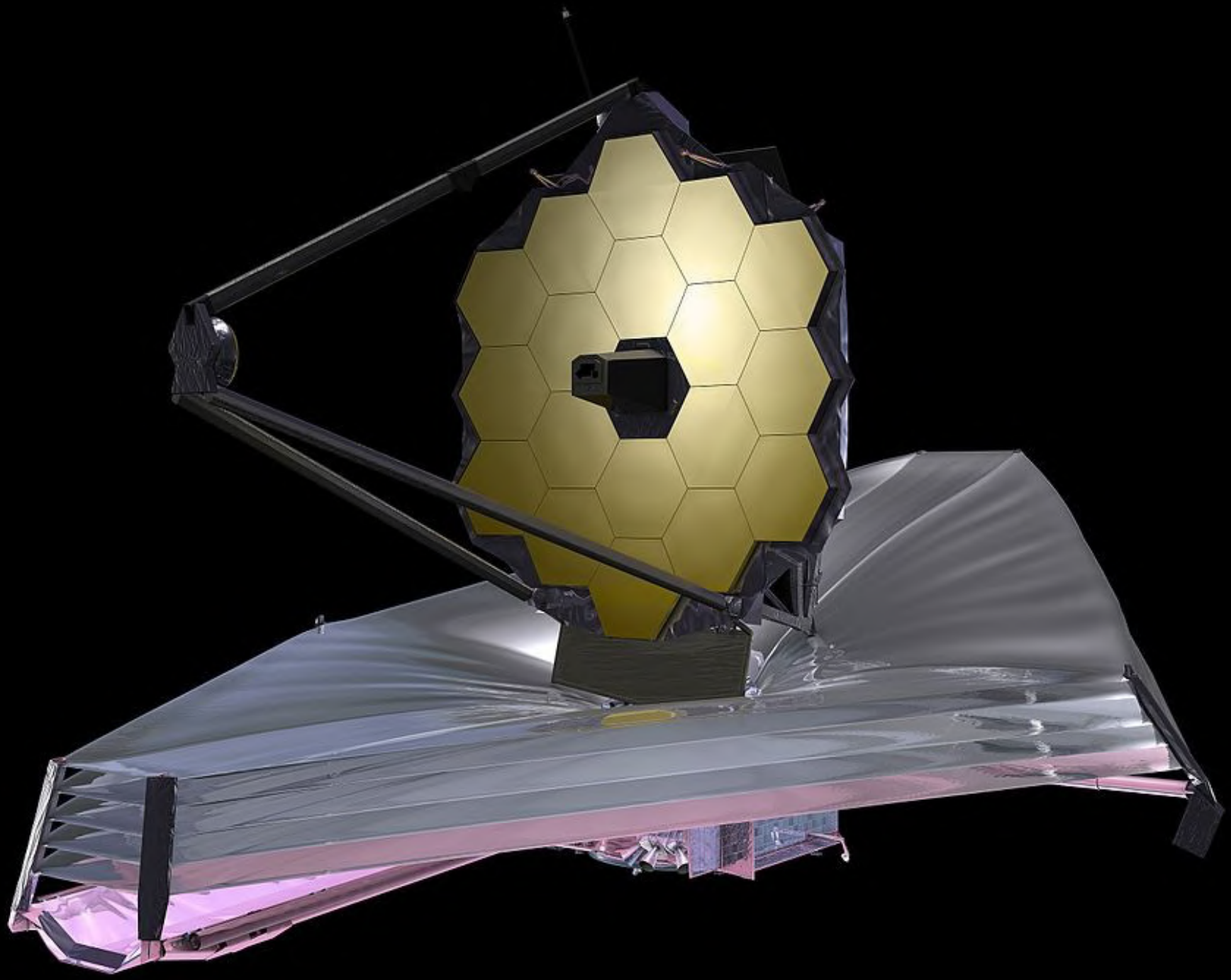
Costruzione completata nel 2017

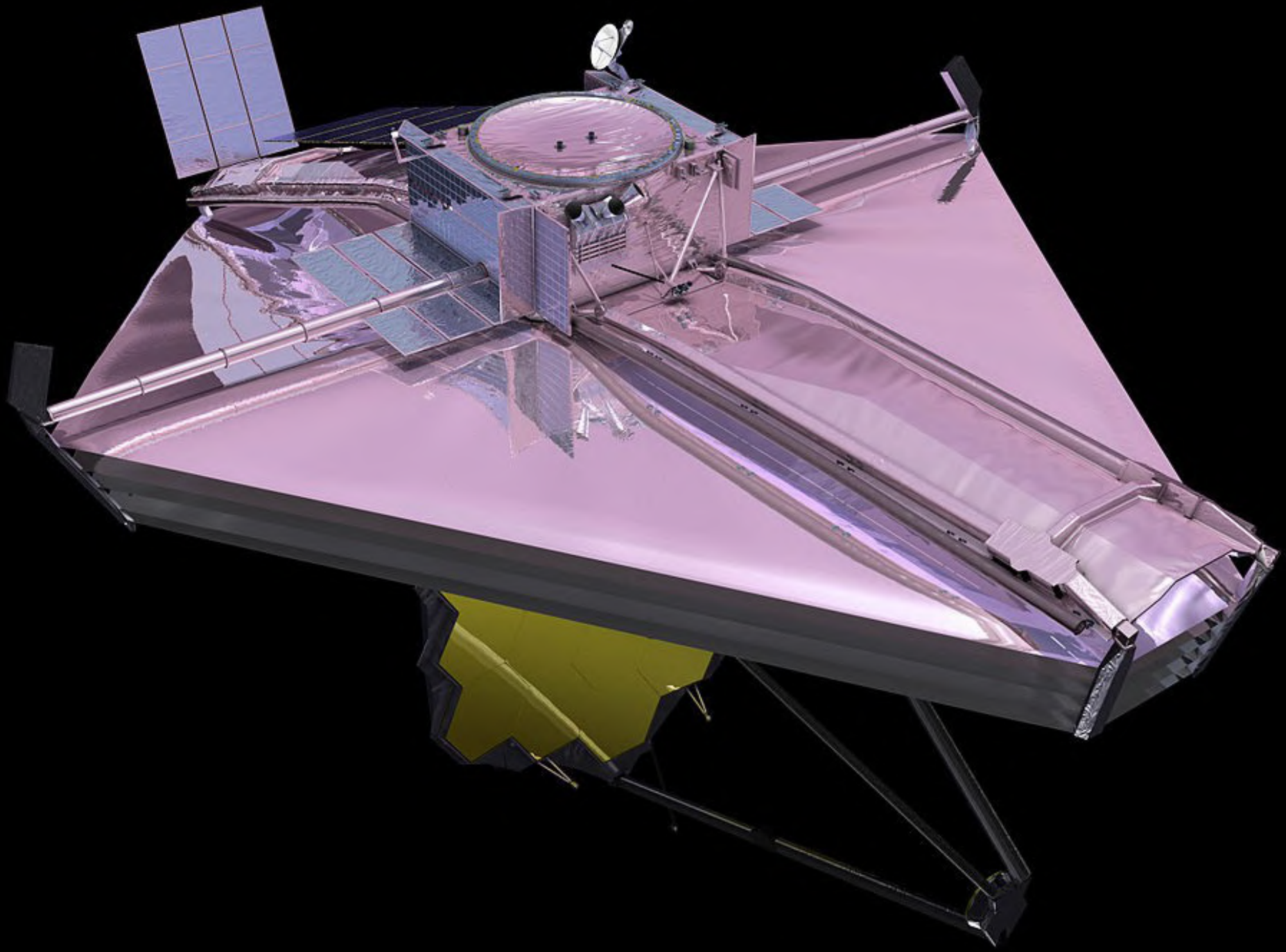
Multipli problemi (cryocooler, schermo termico, valvole, COVID, vibrazioni del fairing) hanno ritardato il lancio fino al 2021

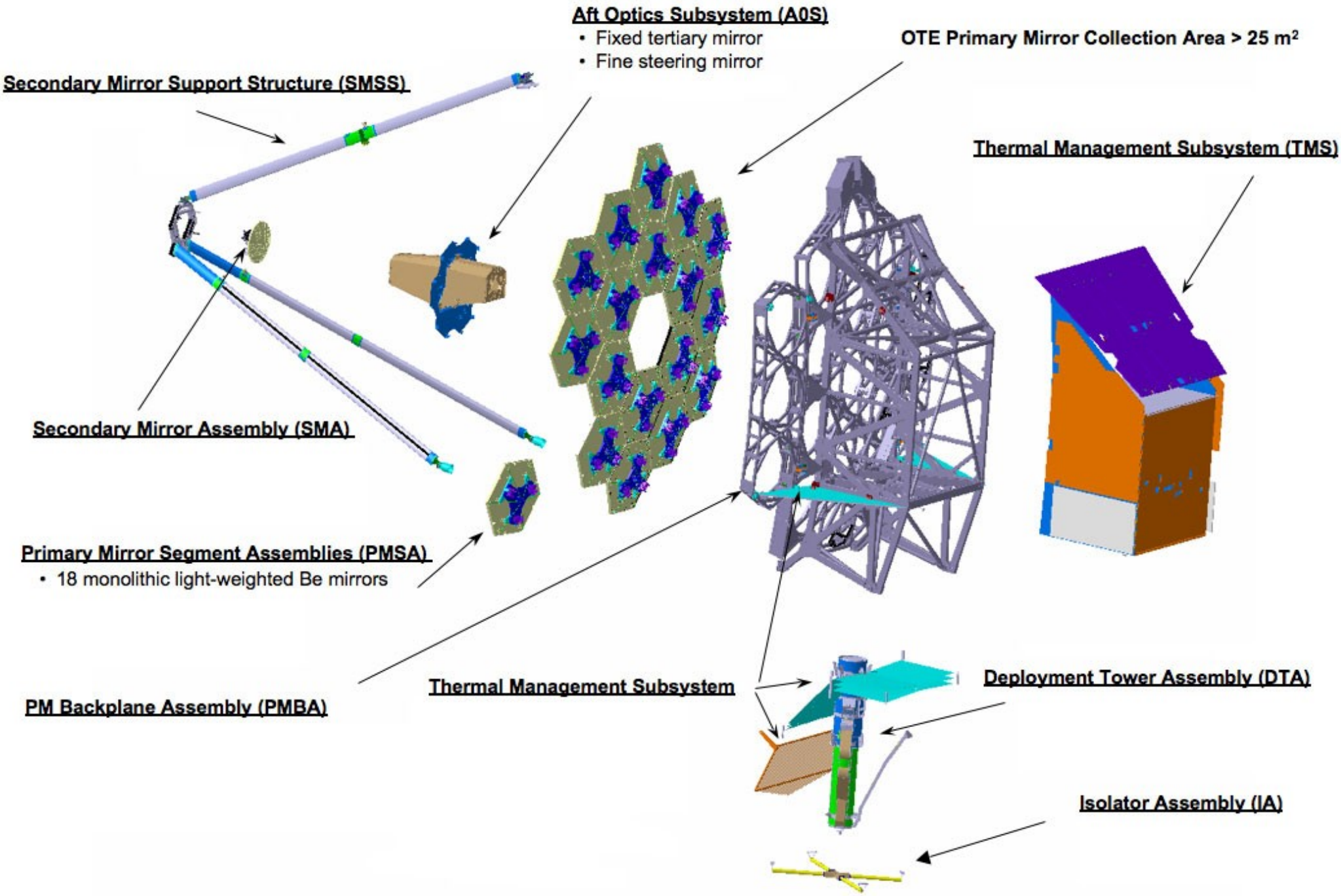
Costo finale nell'ordine di 10 miliardi di $

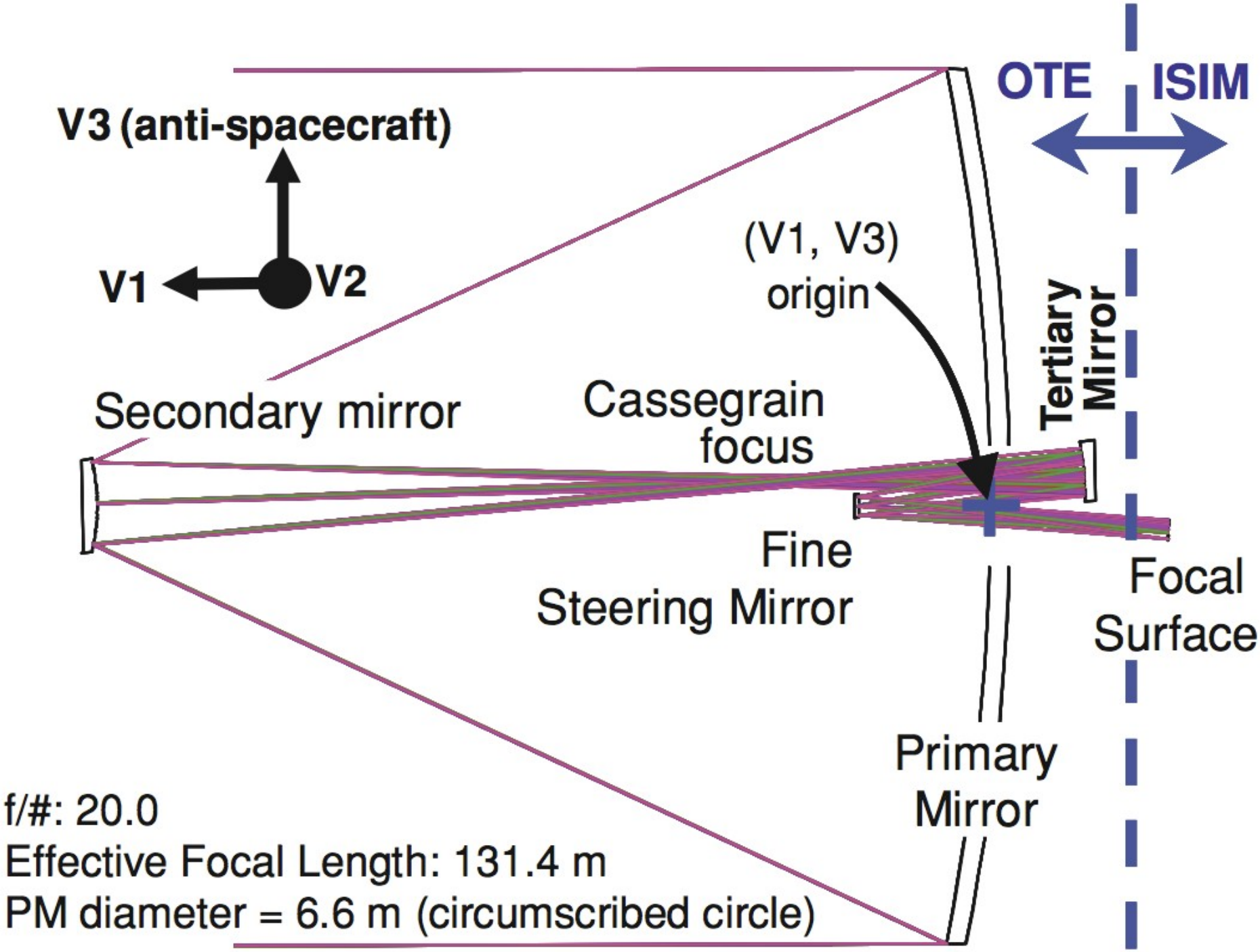



SPACE TELESCOPE COMPARISON
Mirror diameter (metres)
7
6
5
4
3
2
1
0
James Webb
Herschel
Hubble
Detectable spectrum
Herschel
James Webb
Hubble
(Nicmos)
X-Rays
Ultraviolet
Visible
Infrared
Radio
SOURCE: ESA

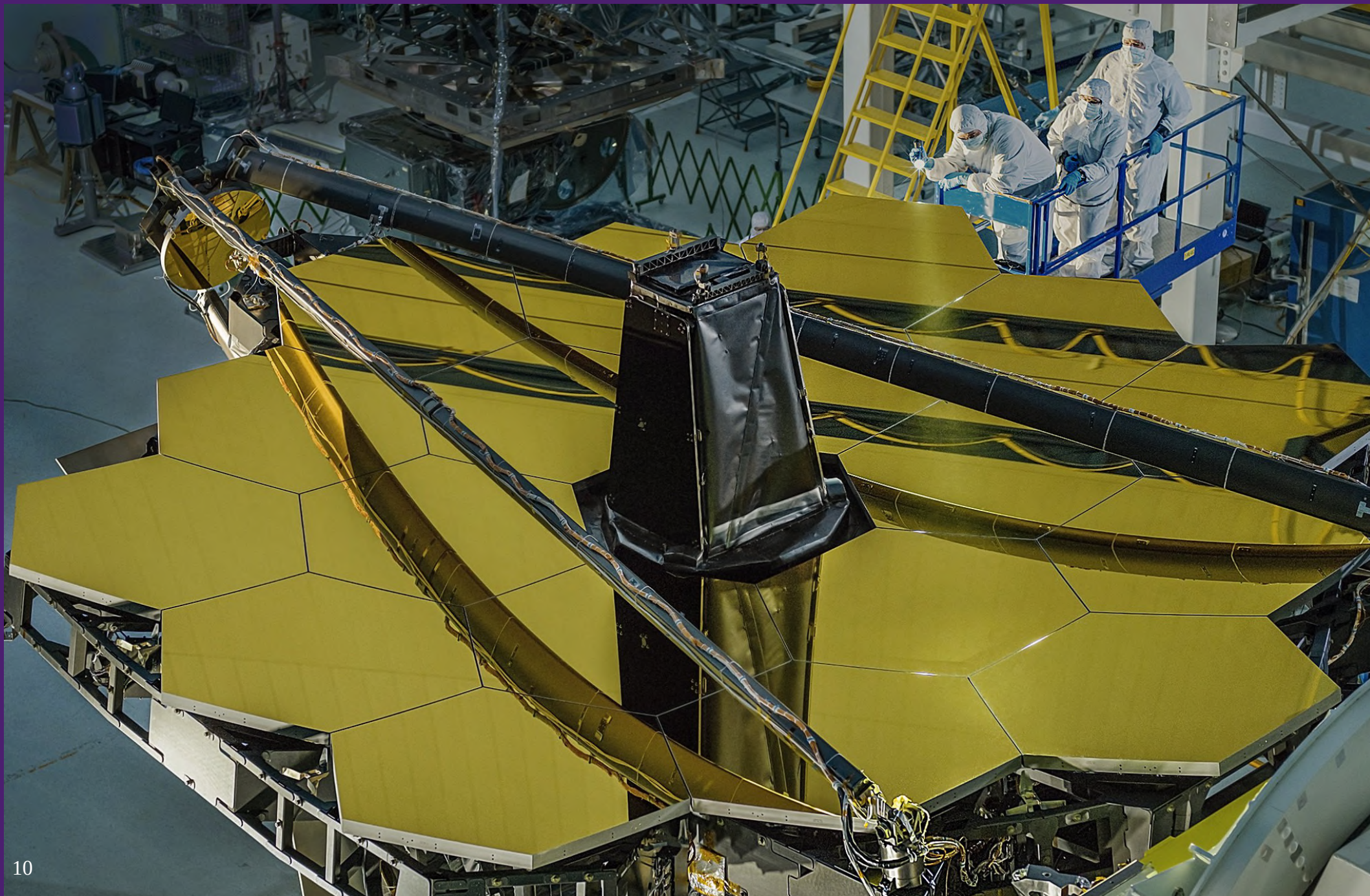





Aft Optics Subsystem (A0S)
• Fixed tertiary mirror
• Fine steering mirror
OTE Primary Mirror Collection Area > 25 m²
Secondary Mirror Support Structure (SMSS)
Thermal Management Subsystem (TMS)
Secondary Mirror Assembly (SMA)
Primary Mirror Segment Assemblies (PMSA)
• 18 monolithic light-weighted Be mirrors
PM Backplane Assembly (PMBA)
Thermal Management Subsystem
Deployment Tower Assembly (DTA)
Isolator Assembly (IA)


OTE
ISIM
V3 (anti-spacecraft)
V1
V2
(V1, V3)
origin
Tertiary
Mirror
Secondary mirror
Cassegrain
focus
Fine
Steering Mirror
Focal
Surface
Primary
Mirror
f/#: 20.0
Effective Focal Length: 131.4 m
PM diameter = 6.6 m (circumscribed circle)

EXIT

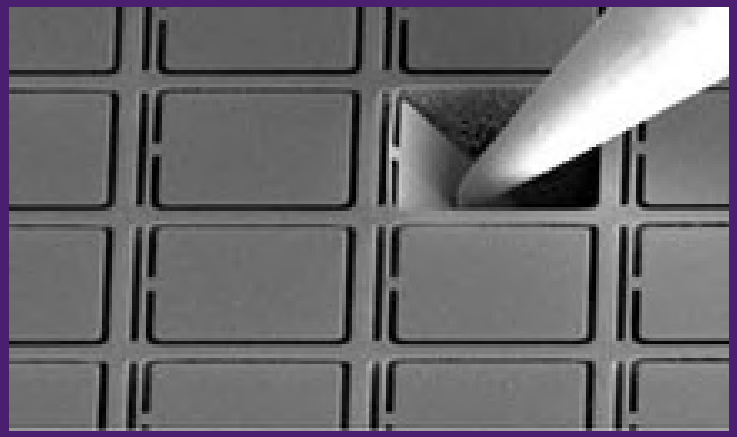


# Mockup di JWST nel campus di Goddard della NASA (2005)

## Strumenti scientifici a bordo del Webb:

NIRCam (Near-Infrared Camera) – camera per imaging da 0,6 a 5 mm [Univ. Arizona e Lockheed-Martin]

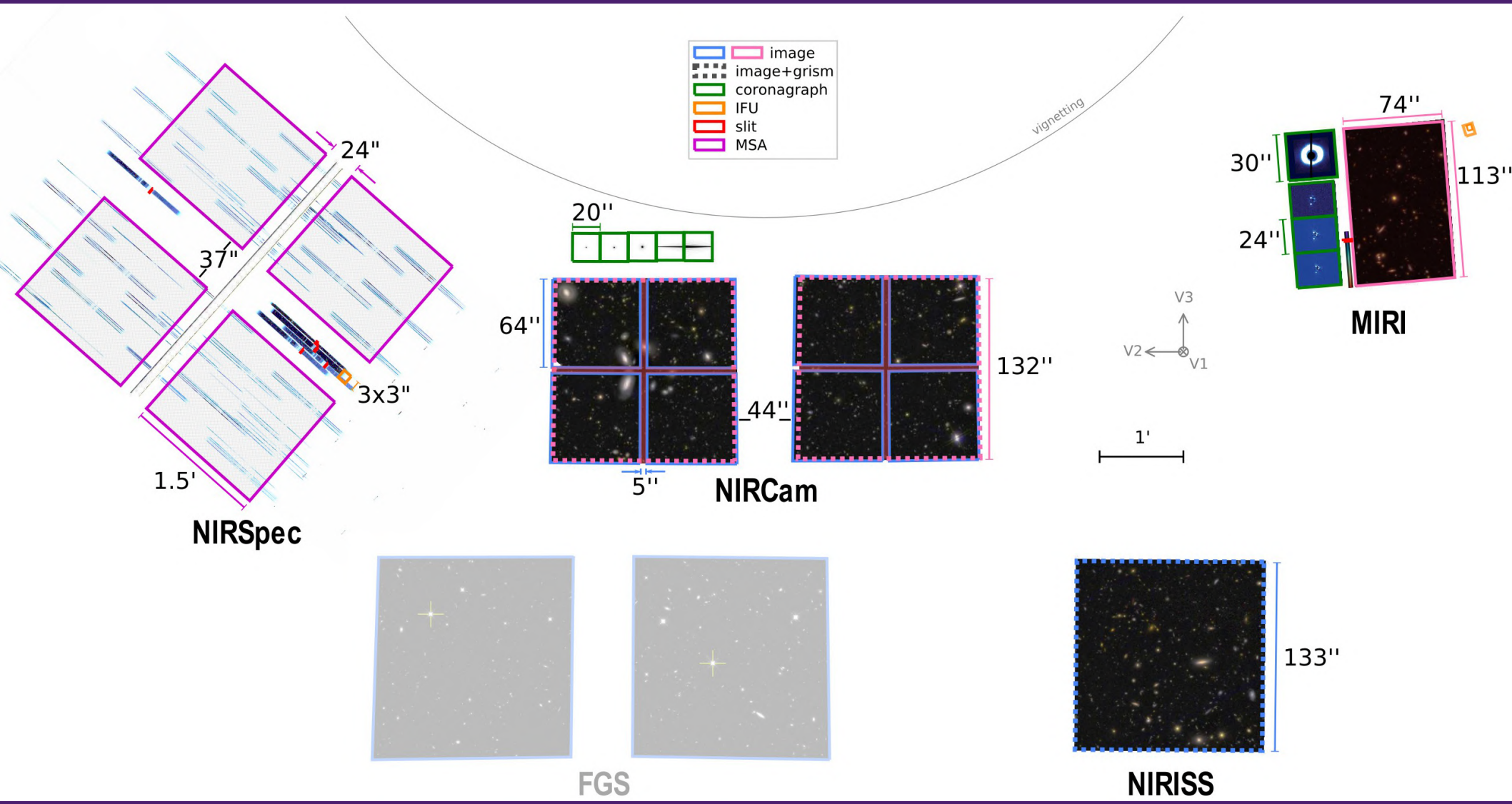
NIRSpec (Near Infrared Spectrograph) stessa banda, spettrometro con schiera di microotturatori [Airbus - Carl Zeiss – Astrium]



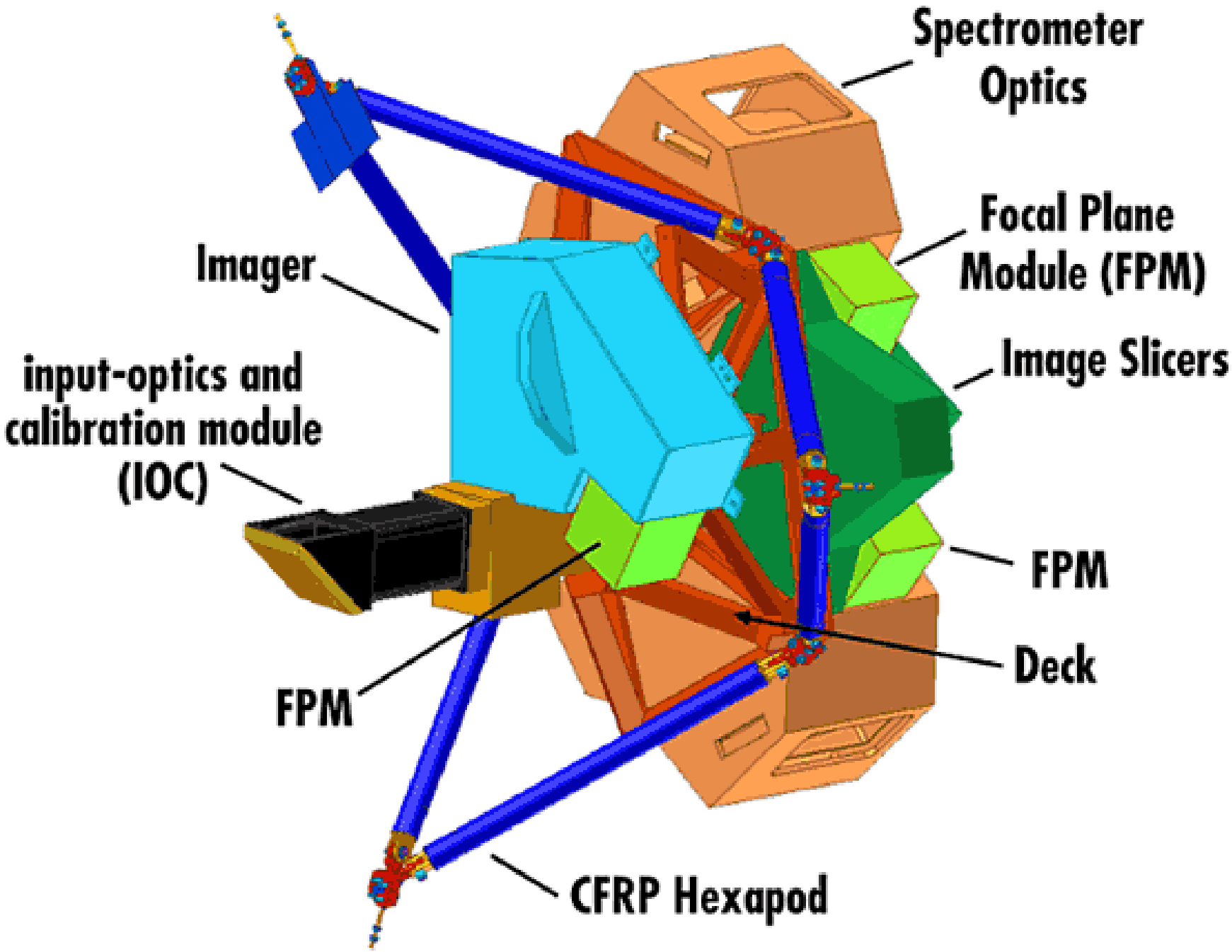
FGS/NIRISS (Fine Guidance System/Near-InfraRed Imager and Slitless Spectrograph) – guida fine e spettroscopia 0,8 – 5 mm – [CSA]

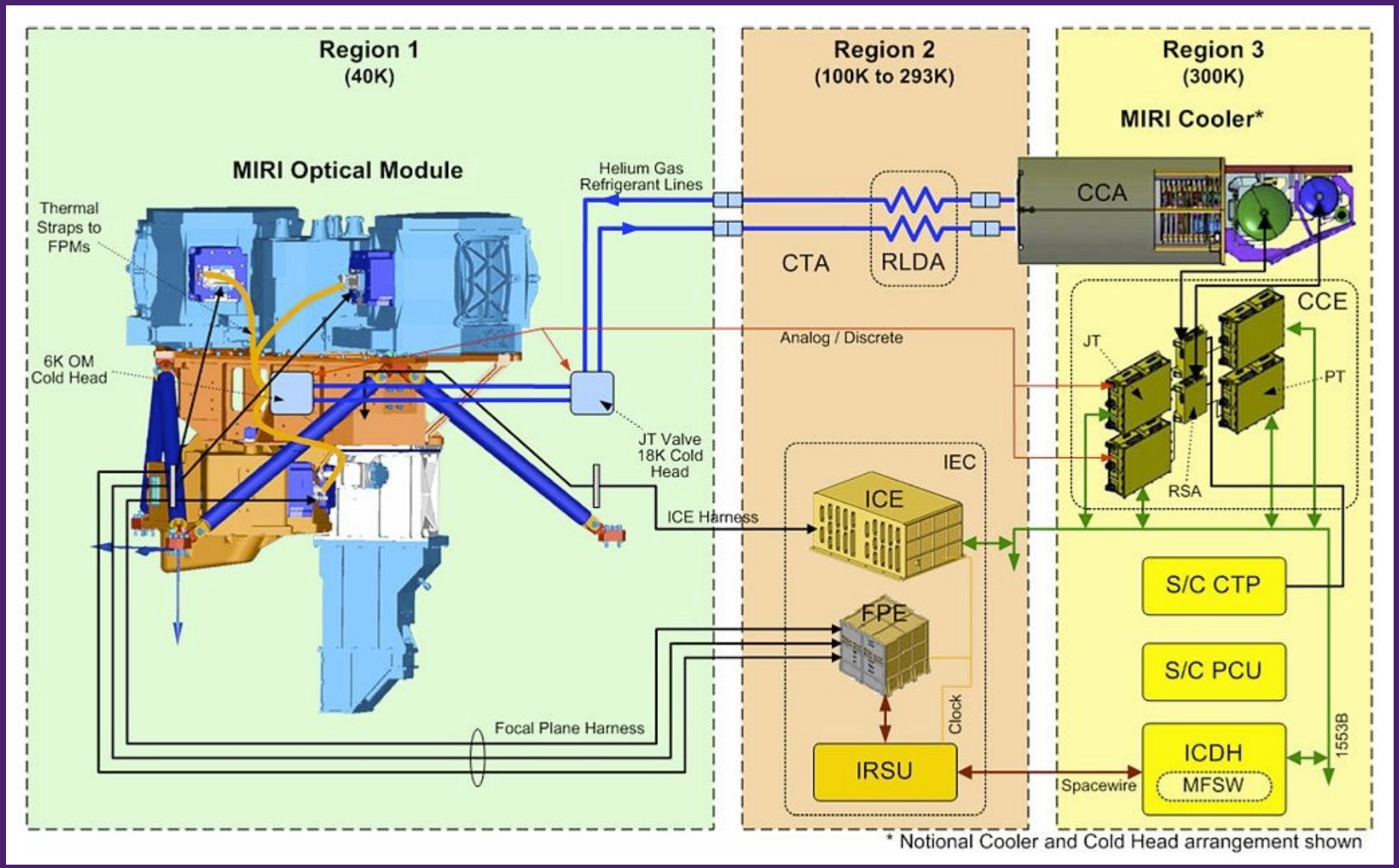
MIRI (Mid-Infrared Instrument) – camera + spettrometro 5 a 27 mm Ha coronografi per osservare esopianeti [NASA, Max Plank Institute, Carl Zeiss]

# I campi di vista degli strumenti

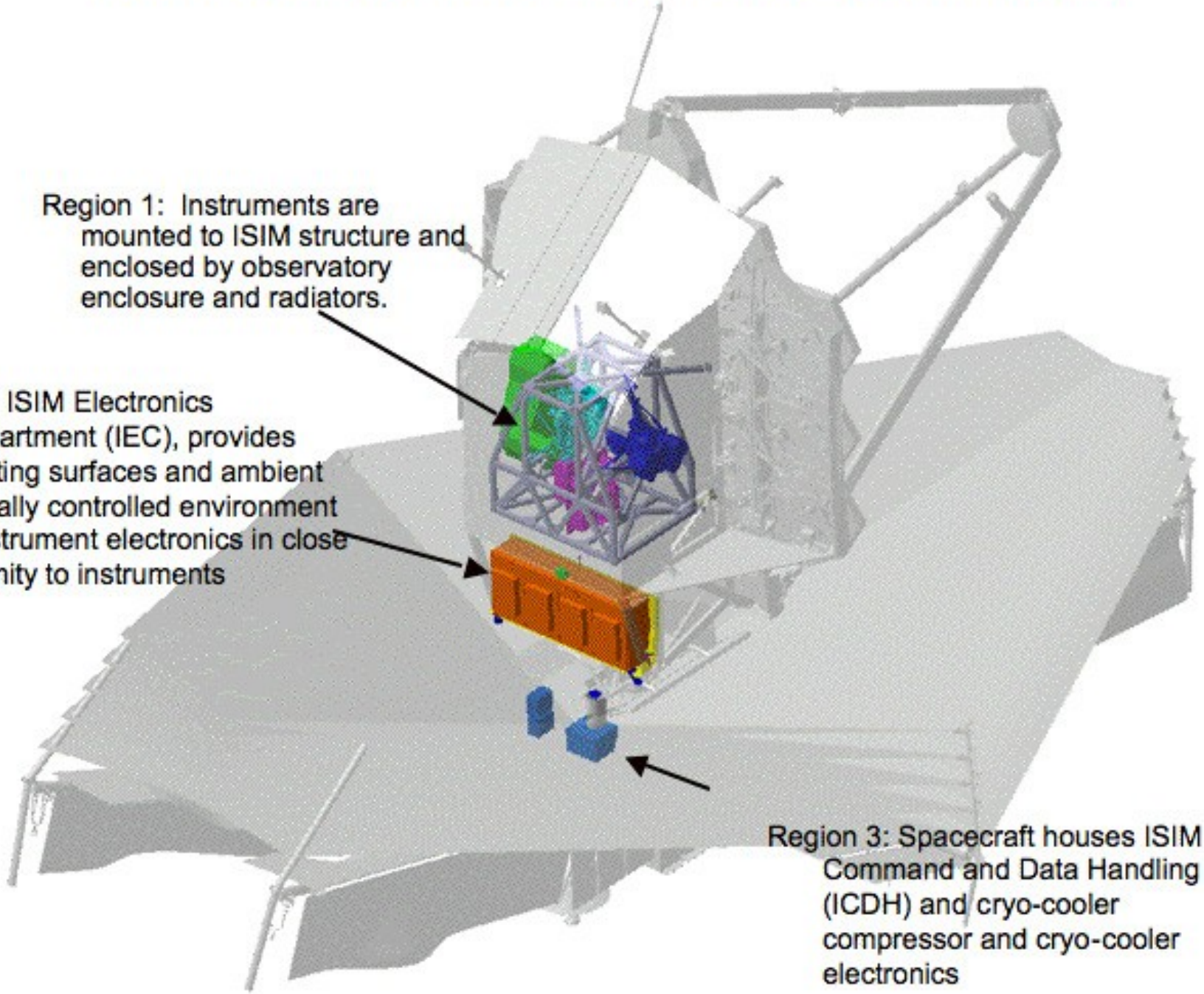


# Mid Infrared Instrument (MIRI)




Region 1
(40K)
Region 2
(100K to 293K)
Region 3
(300K)
MIRI Cooler*
MIRI Optical Module
Helium Gas
Refrigerant Lines
Thermal
Straps to
FPMs
6K OM
Cold Head
CTA
RLDA
CCA
CCE
JT
PT
RSA
Analog / Discrete
JT Valve
18K Cold
Head
IEC
ICE
ICE Harness
FPE
Clock
IRSU
S/C CTP
S/C PCU
ICDH
MFSW
1553B
Spacewire
Focal Plane Harness
* Notional Cooler and Cold Head arrangement shown

# ISIM Components within the Observatory



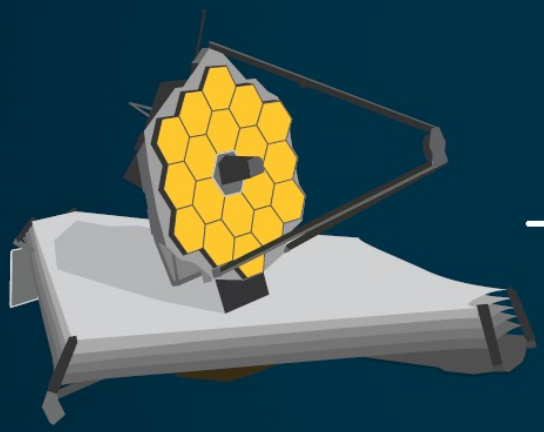
# WEBB E ARIANE 5: UNA COMBINAZIONE PERFETTA

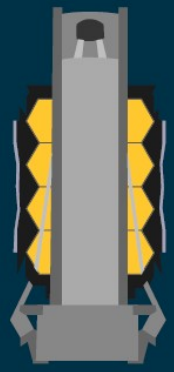
ESA lancerà Webb su un razzo Ariane 5, che è stato adattato alle esigenze specifiche di questo straordinario telescopio.

## Webb

**Altezza**
8 m

**Schermo solare a 5 strati**
21.2 x 14.2 m

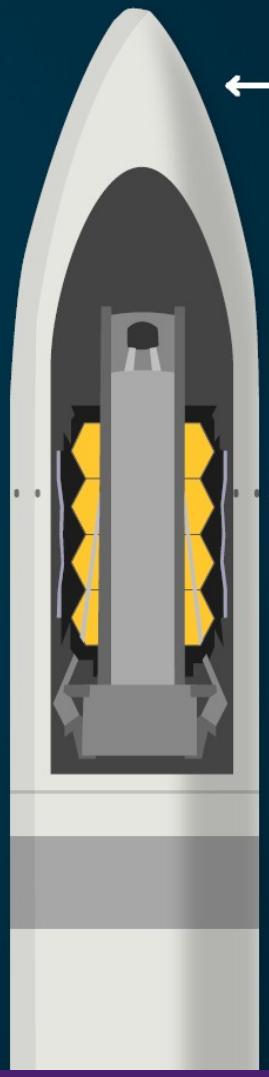




## Webb ripiegato

**Altezza**
10.66 m

**Larghezza**
4.5 m



## Carenatura

**Altezza**
17 m

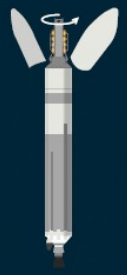
**Diametro**
5.4 m

## 28 porte di sfiato

consentono la depressurizzazione durante la sequenza di lancio

## Monovra di rollio

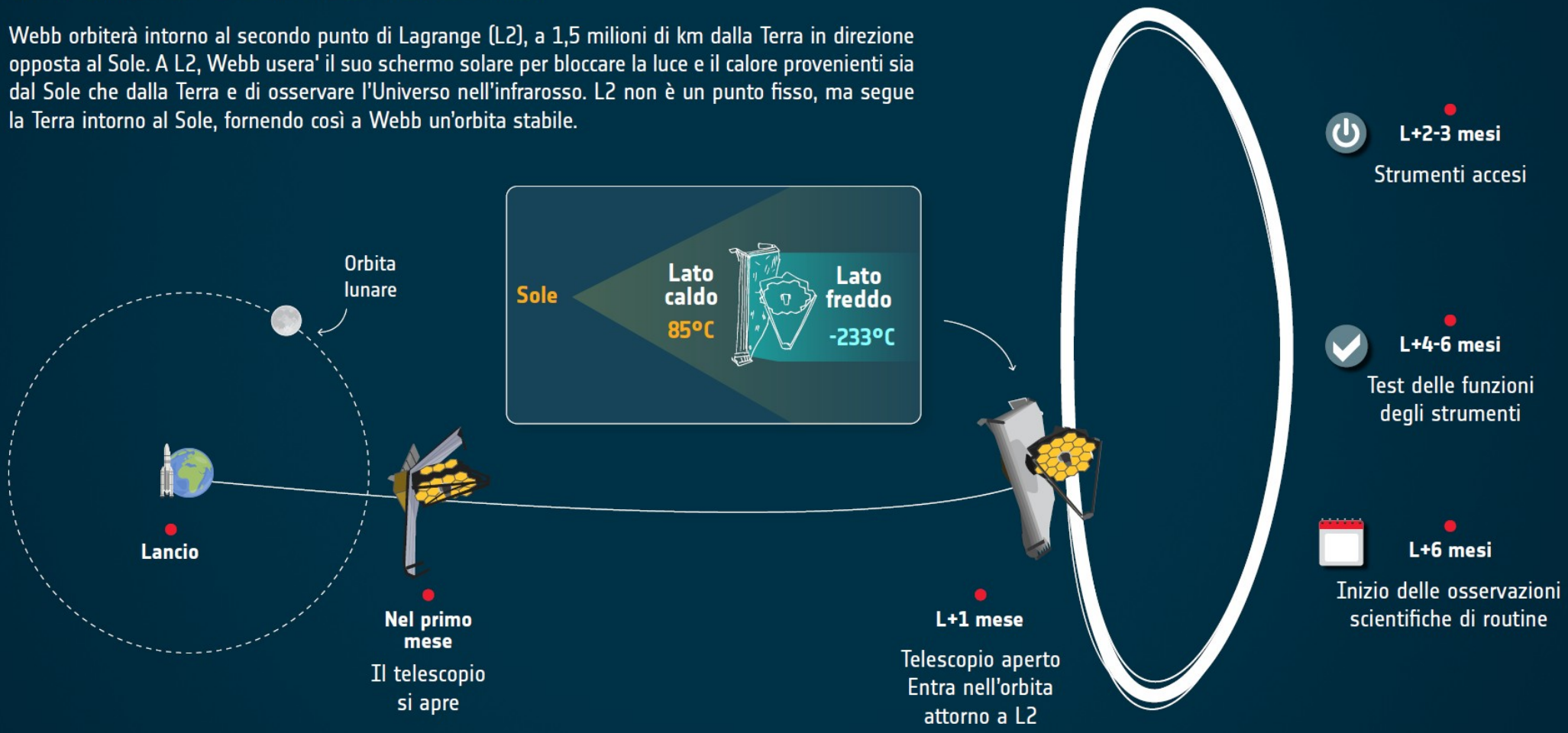
Manovra ondulatoria per proteggere Webb dalla radiazione solare dopo il distacco dalla carenatura



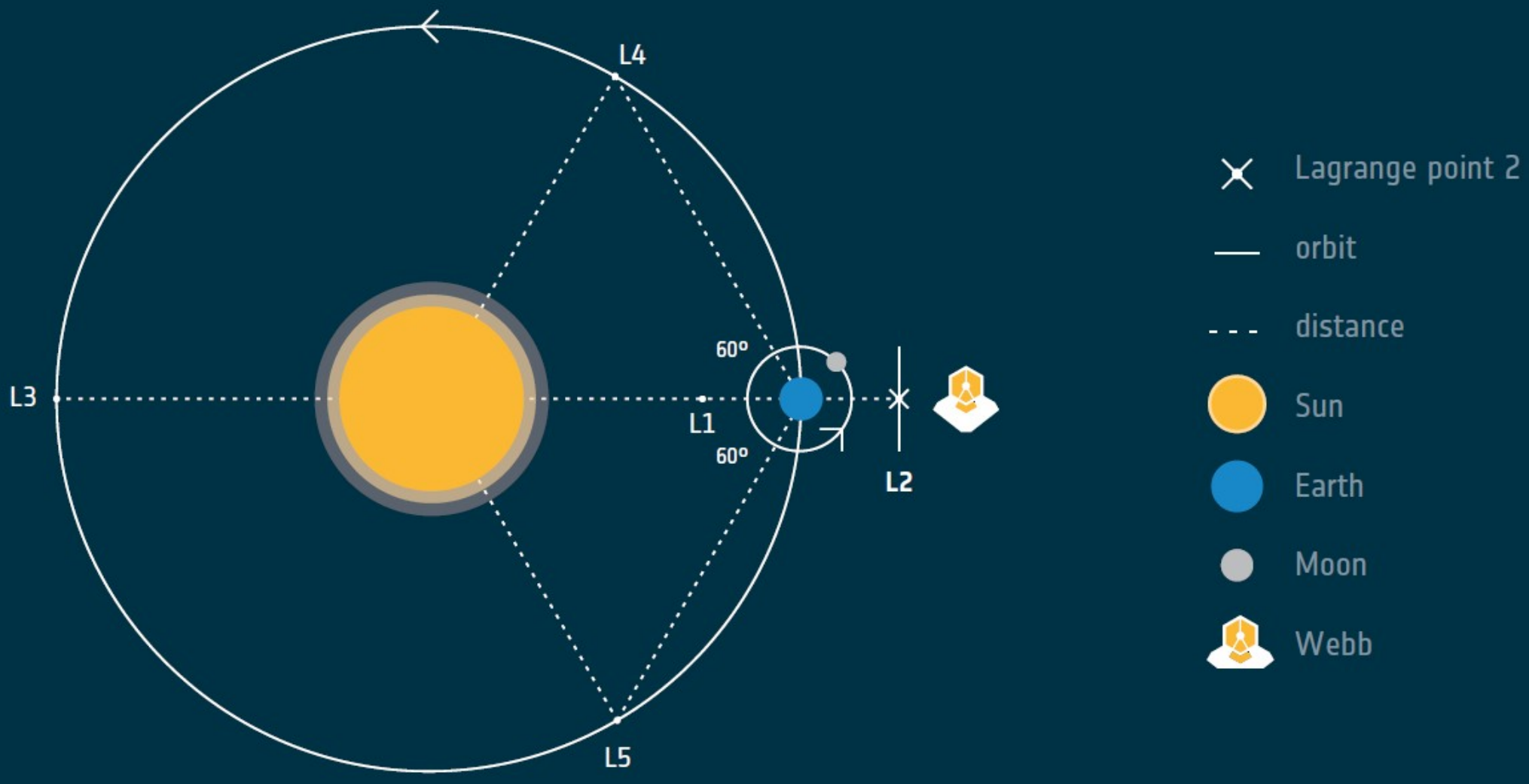
# TABELLA DI LANCIO PRESSO LO PORTO SPAZIALE EUROPEO

# IL VIAGGIO DI WEBB VERSO L2

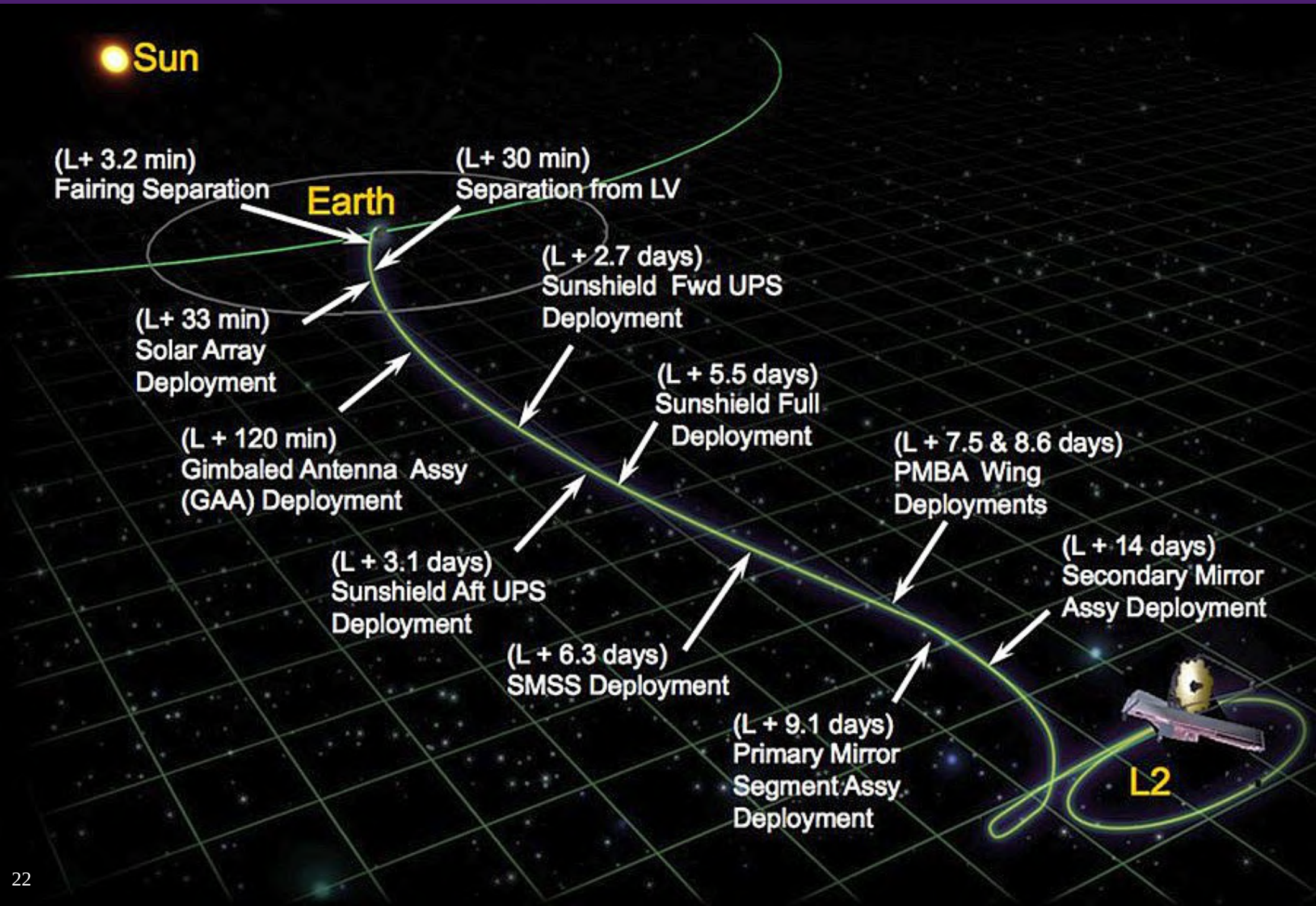
Webb orbiterà intorno al secondo punto di Lagrange (L2), a 1,5 milioni di km dalla Terra in direzione opposta al Sole. A L2, Webb usera' il suo schermo solare per bloccare la luce e il calore provenienti sia dal Sole che dalla Terra e di osservare l'Universo nell'infrarosso. L2 non è un punto fisso, ma segue la Terra intorno al Sole, fornendo così a Webb un'orbita stabile.



# I punti lagrangiani



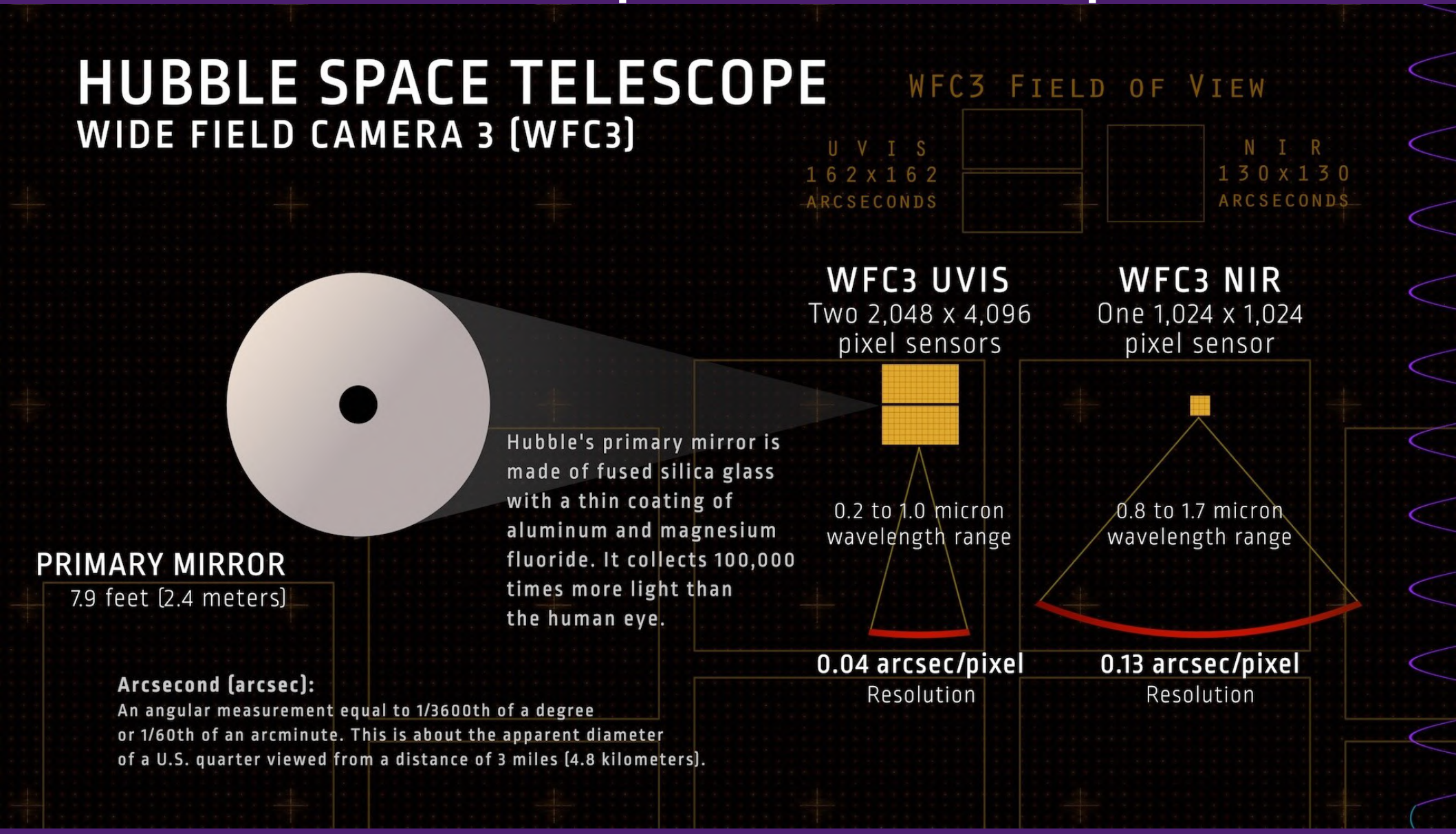
# Dal lancio a L2



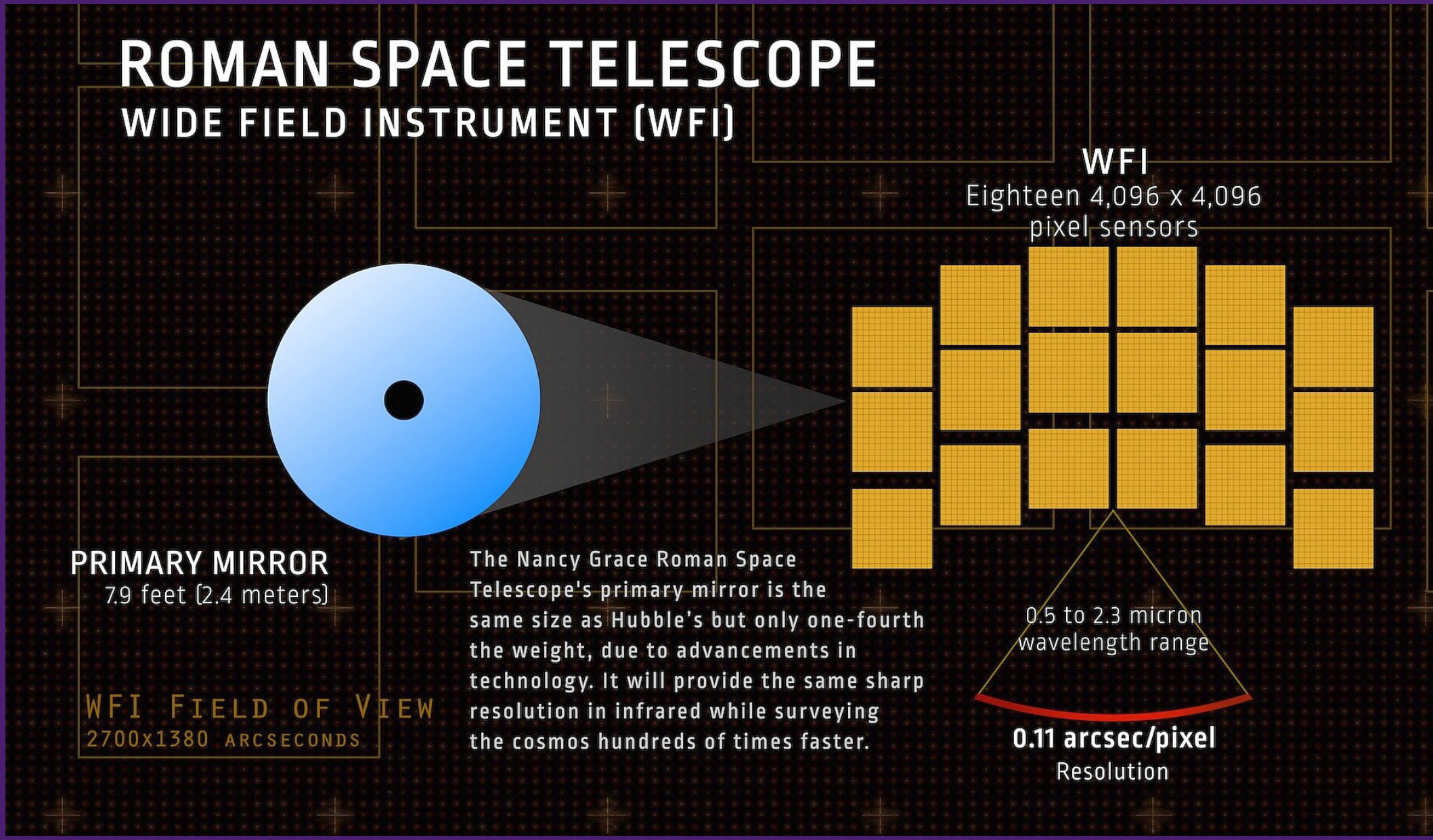
# Obiettivi scientifici di JWST

- Universo antico – era della reionizzazione, prime stelle, prime galassie
- Sviluppo delle prime galassie
- Materia oscura ed energia oscura
- Formazione stellare e planetaria
- Mezzo interstellare
- Esopianeti, identificazione delle atmosfere e quindi condizioni che possono permettere la vita

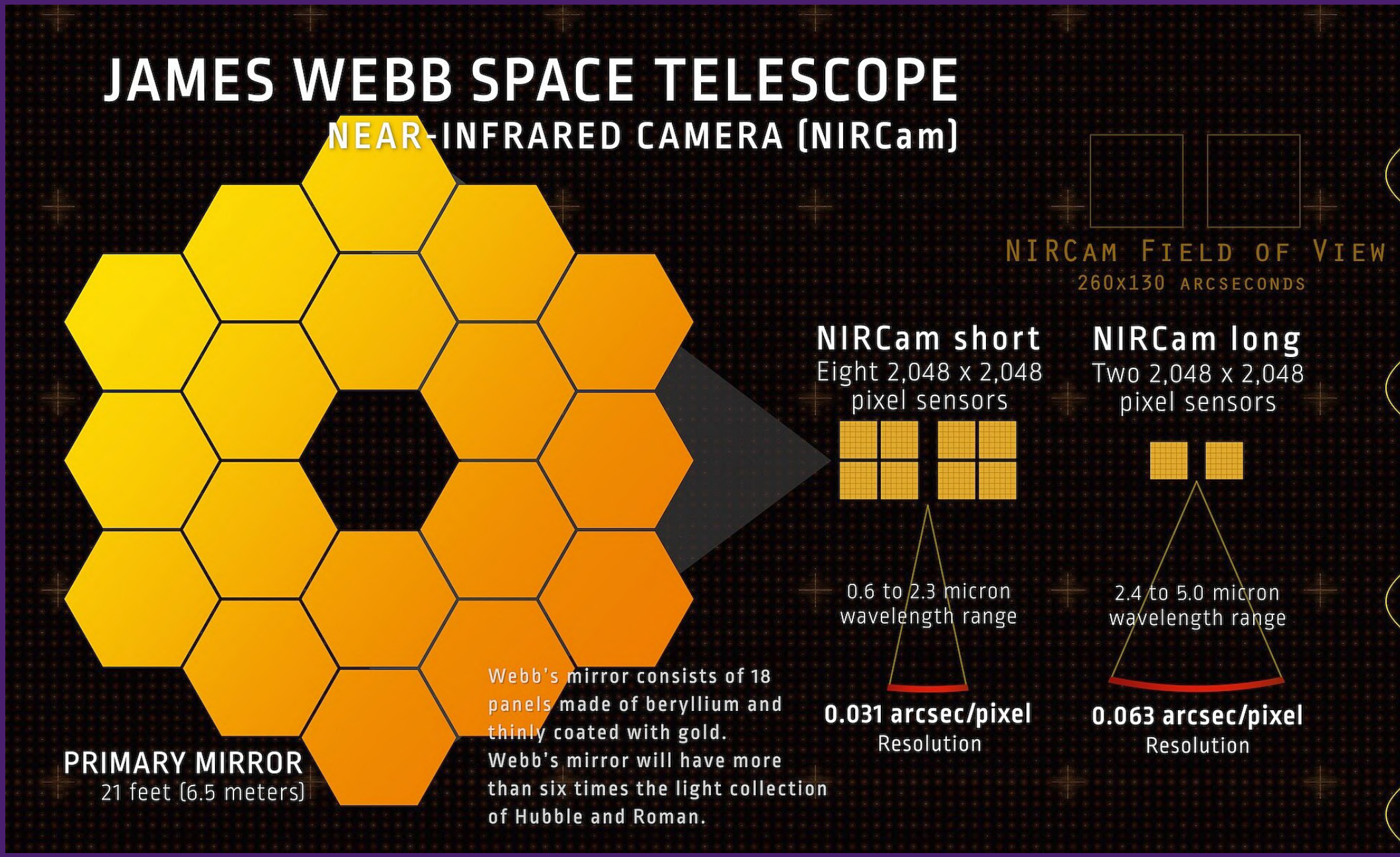
# Hubble Space Telescope



# Nancy Grace Roman Space Telescope (ex WFIRST)

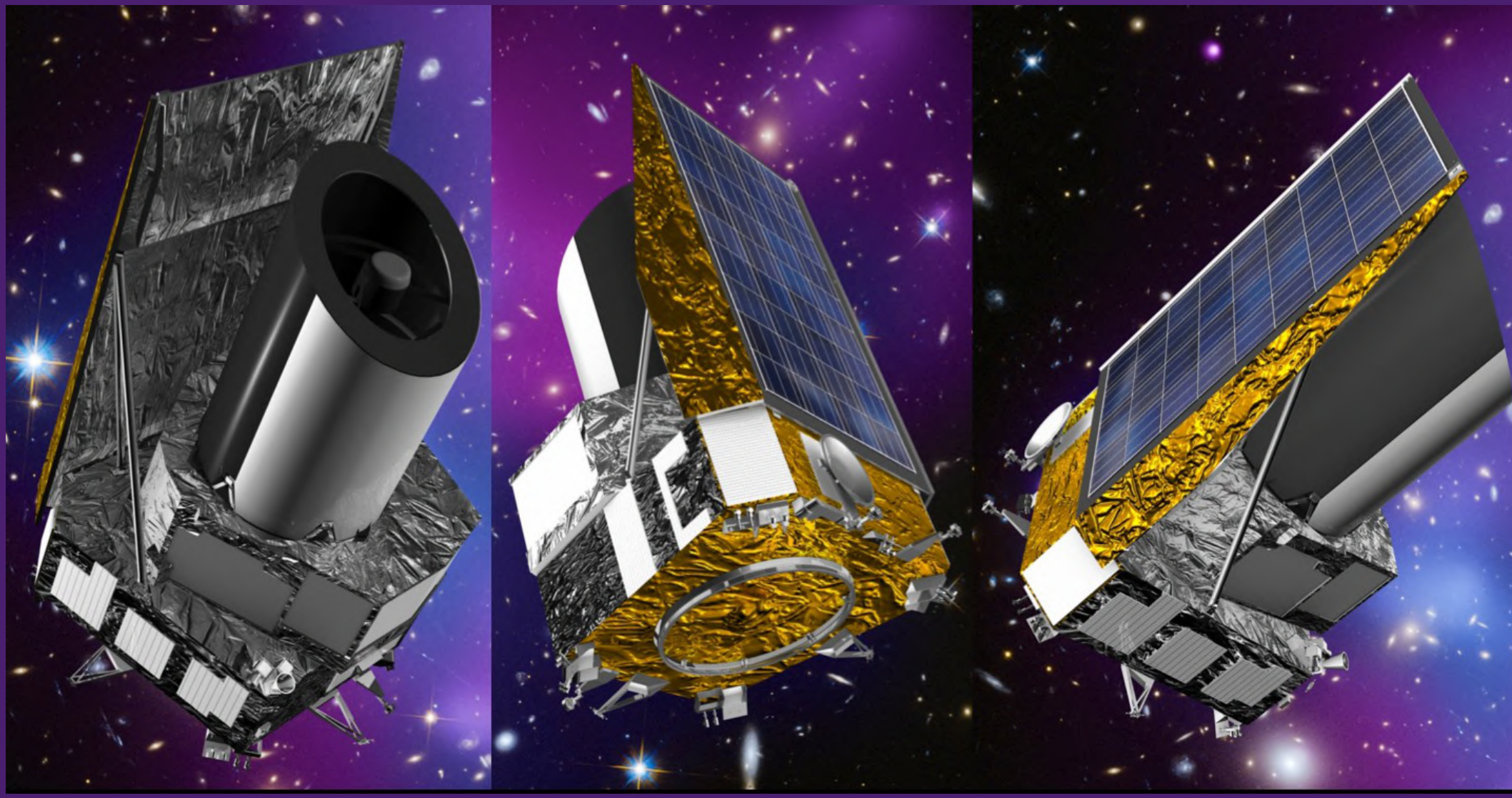


# E JWST


JAMES WEBB SPACE TELESCOPE
NEAR-INFRARED CAMERA (NIRCam)
NIRCAM FIELD OF VIEW
260x130 ARCSECONDS
NIRCam short
Eight 2,048 x 2,048 pixel sensors
NIRCam long
Two 2,048 x 2,048 pixel sensors
0.6 to 2.3 micron wavelength range
2.4 to 5.0 micron wavelength range
0.031 arcsec/pixel
Resolution
0.063 arcsec/pixel
Resolution
PRIMARY MIRROR
21 feet (6.5 meters)
Webb's mirror consists of 18 panels made of beryllium and thinly coated with gold.
Webb's mirror will have more than six times the light collection of Hubble and Roman.

# ESA Euclid!

IR, specchio da 1,2 m, survey a grande campo
260 GB/giorno di dati, lancio nel 2022



esa
AV
AV N°02
COTÉ A
POSER
EN 1ER
CONVOI EXCE

Austrian Aerospace

# In attesa del lancio (18/12 alle 13:10)... Grazie per l'attenzione!

Marco Bruno
C.P.A.P. 2021