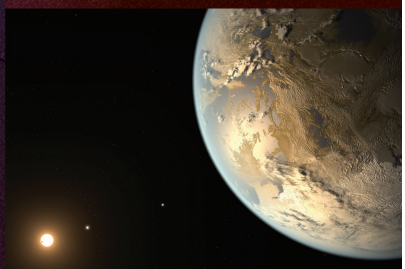
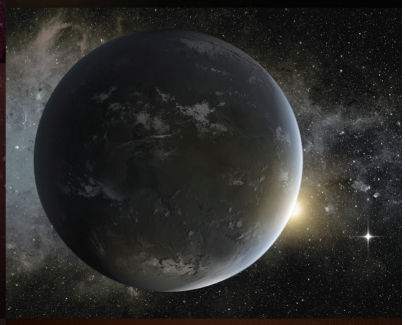
National Aeronautics and Space Administration

NASA

HABITABLE EXOPLANET OBSERVATORY





HabEx

Exploring planetary systems around nearby sunlike stars and enabling new explorations of astrophysical systems from our solar system to galaxies and the universe in the UV through near-IR.

The Habitable Exoplanet Observatory (HabEx) is one of four mission concepts currently being studied by NASA in preparation for the Astrophysics 2020 Decadal Survey. The HabEx baseline architecture is designed to optimize direct imaging and spectroscopy of reflected light from exoplanets in planetary systems around nearby sun-like stars using both coronagraph and starshade instruments. HabEx is also designed to enable a broad range of UV - NIR general astrophysics with two dedicated instruments, the HabEx Workhorse Camera (HWC) and the Ultraviolet Spectrograph (UVS). The HabEx design relies on demonstrated, yet cutting-edge, technologies wherever possible, which enables world-leading science in the 2030's while limiting risk and cost.

Visit the HabEx website at: www.jpl.nasa.gov/habex

HabEx Technical Fact Sheet

Habitable Exoplanet Observatory

Mission Duration:	5 years
Orbit:	Earth-Sun L2 Halo orbit
Aperture:	4-meter unobscured
Telescope Architecture:	off-axis, Three Mirror Anastigmat (TMA)
Primary Mirror:	f-number: f/2.5 construction: monolith reflective coating: Al+MgF2
Wavelengths:	0.115 µm - 1.8 µm (UV, Vis, NIR)
Instruments:	- Coronagraph - Starshade Camera + Starshade Occulter - High-Resolution UV Spectrograph - Multi-purpose, Wide-field Camera & Spectrograph
Starshade	52-meter diameter starshade occulter
Attitude Control System (ACS):	- Fine-Guiding Sensor Instrument - monoprop thrusters (slewing) - microthrusters (pointing)
Formation Flying Control System:	- position sensor - local communications
Communications:	phased-array antenna
Serviceability:	- instruments (4) - tertiary mirror assembly including fine guiding sensors - thrusters - avionics - communications - refueling: telescope + starshade

Coronagraph Instrument

Purpose:	Exoplanet Search & Characterization
Wavebands:	Visible: 0.45 µm - 1.0 µm (in four 20% bands) NIR: 0.975 µm - 1.8 µm (in three 20% bands)
Coronagraph "A"	Visible Channel: - Camera, 1k x 1k EMCCD - IFS, R = 140, 2k x 2k EMCCD
Coronagraph "B"	Visible Channel: - Camera, 1k x 1k EMCCD - IFS, R = 140, 2k x 2k EMCCD NIR Channel: - Camera, 256x320 LMAPD - IR IFS R = 40
Coronagraph Type:	Vector Vortex Charge 6
Inner Working Angle (IWA):	2.4 λ/D 62 mas @ 0.5 µm
Outer Working Angle (OWA):	32 λ/D 830 mas @ 0.5 µm
Starlight Suppression Raw Contrast:	$\leq 10^{-10}$
Deformable Mirror:	64x64 0.4-mm pitch
Wavefront Control subsystem:	Low-Order Wavefront Sensor (LOWFS) Fine Steering Mirror (FSM)

Starshade Instrument / Occulter

Purpose:	Exoplanet Deep Characterization
Starshade Occulter	
Starshade Occulter Optimized waveband:	0.3 µm - 1.0 µm
Starshade separation:	76,600 km (for Visible Channel)
Starshade diameter:	52-meter
Starlight Suppressioin Raw Contrast:	$\leq 10^{-10}$
Inner Working Angle (IWA):	UV band "blue" @ 0.2 - 0.667 µm: 47 mas Vis band "green" @ 0.3 - 1.0 µm: 70 mas NIR band "red" @ 0.54 - 1.8 µm: 126 mas
Propulsion:	Slewing: Solar Electric Hall Effect Thrusters ACS: Biprop Thrusters
Starshade Instrument	
Wavebands:	UV: 0.20 µm - 0.45 µm Vis: 0.45 µm - 1.0 µm NIR: 0.95 µm - 1.8 µm
Channels:	UV Channel: - Guide Camera: 1kx1k CCD201 - Grism Spectrograph, R = 7 Visible Channel: - Camera: 1kx1k CCD201 - IFS, R = 140, 4kx4k CCD282 NIR Channel: - Guide Camera: 256x320 LMAPD - IR IFS, R = 40, 2kx2k LMAPD
Field of View Diameter:	UV Spectrograph- 10.2 arc seconds Vis Camera- 11.9 arc seconds Vis IFS- 1.9 arcseconds, IR IFS- 3.8 arc seconds,

UV Imaging Spectrograph (UVS) Instrument

Purpose:	High resolution, UV imaging and spectroscopy for observatory science
Waveband: - Spectroscopy:	0.115 µm – 0.32 µm (20 bands)
Telescope Diffraction Limit:	0.4 µm
Field of view:	3 arcmin x 3 arcmin
Spectral Resolution:	R = 500 – 60,000 (in seven settings)
Detector	- 3x5 MCP array, ~100 mm sq each - 17000 x 30000 pixels
Multi-Object Spectroscopy (MOS) capable	Micro-shutter array, 2x2 array 180x80 um 171x365 apertures

HabEx Workhorse Camera (HWC) Instrument

Purpose:	Multi-purpose, wide-field imaging camera and spectrograph for observatory science
Waveband:	
- Vis:	- 0.37 µm – 0.95 µm
- NIR:	- 0.95 µm - 1.8 µm
Telescope Diffraction Limit:	0.4 µm
Field-of-view:	3 arcmin x 3 arcmin
Spectral Resolution:	R = 1000
Detector:	
- Vis:	- 3x3 CCD203 12288x12288 pixels
- NIR:	- 2x2 H4RG10 8192x8192 pixels
Multi-Object Spectroscopy (MOS) capable	Micro-shutter array, 2x2 array 180x80 um 171x365 apertures

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

The HabEx study is being undertaken by a Science and Technology Definition Team (STDT) comprised of experts within the community and is being managed by NASA's Jet Propulsion Laboratory in Pasadena, CA.

Visit the HabEx website at: www.jpl.nasa.gov/habex