

A 3D cutaway rendering of the WISH satellite, showing its internal components including a large yellow circular structure, various colored panels (blue, yellow, green), and a complex network of pipes and mechanical parts. The satellite is set against a dark background with a bright blue light source on the left and a bright white light source on the right, creating a dramatic effect.

# WISH

WISH: Wide-field Imaging Surveyor for High-Redshift  
超広視野初期宇宙探査衛星

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on behalf of

WISH Working Group

<http://www.wishmission.org/en/index.html>

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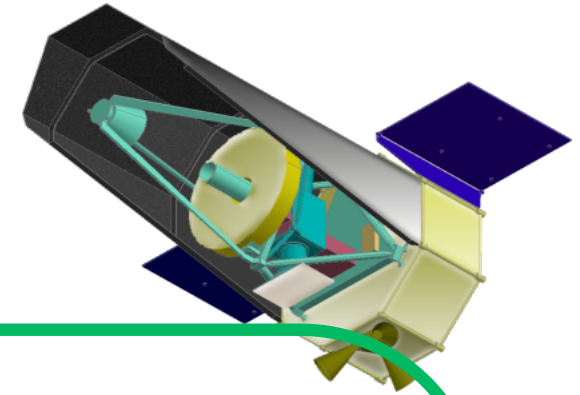
M.Do, N.Yasuda (University of Tokyo)

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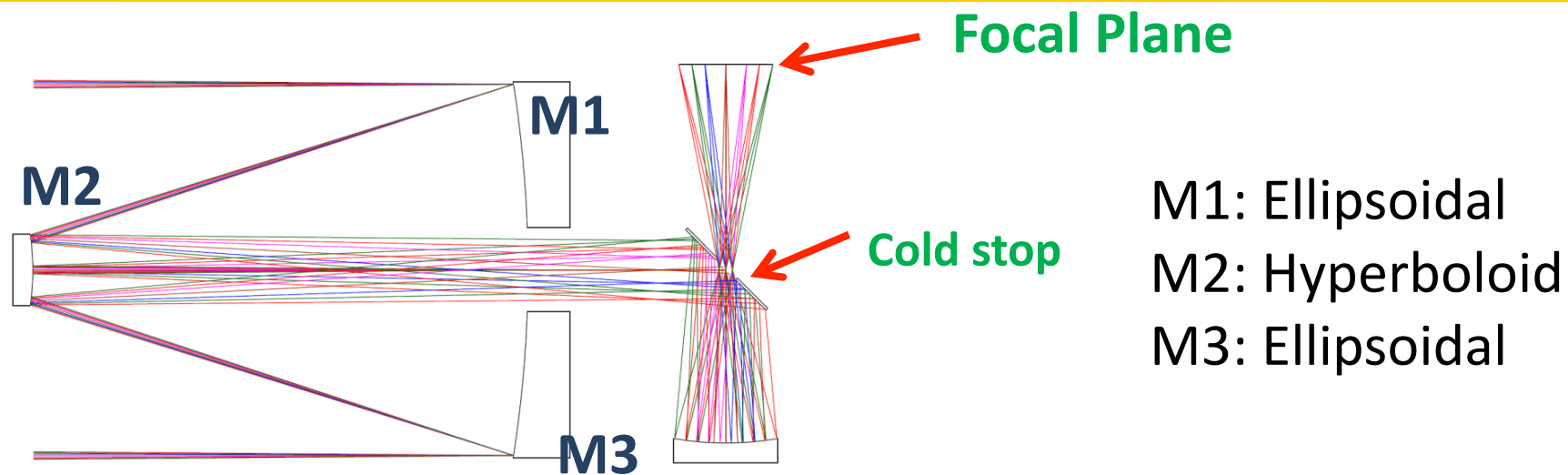
Y.Ikeda (Photocoding), S.Iwamura (M.R.J)

# WISH Brief Summary



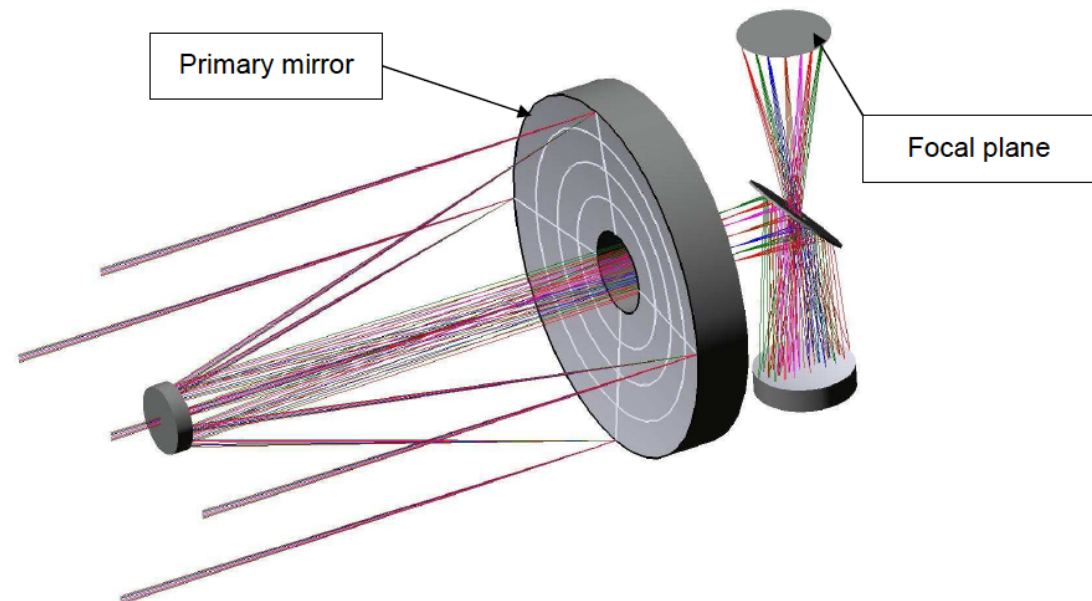
- 1.5m diameter telescope
- Cooled to 90-100K (telescope)
- SE-L2, JAXA HIIA
- NIR Deep and Wide-field Imaging Surveyor
  - 1-5  $\mu\text{m}$  wavelength range
- Very Wide-Field Imager  $\sim 900 \text{ arcmin}^2$  FoV
- pixel scale: 0.155" / 18 $\mu\text{m}$  (f/16)
- Exploring the 1<sup>st</sup> generation galaxies
  - Dedicated,  $\sim 100 \text{ deg}^2$ , 28AB ( $\sim 25 \text{ nJy}$ )
- Concept being developed under JAXA/ISAS  
(the WG was selected in Sept 2008)  
to be launched in late 2010's (NET2018)

# WISH Development: Optical Layout



- Very flat focal plane
- Diffraction-limited images to  $\phi \sim 50'$  at 1-5  $\mu\text{m}$

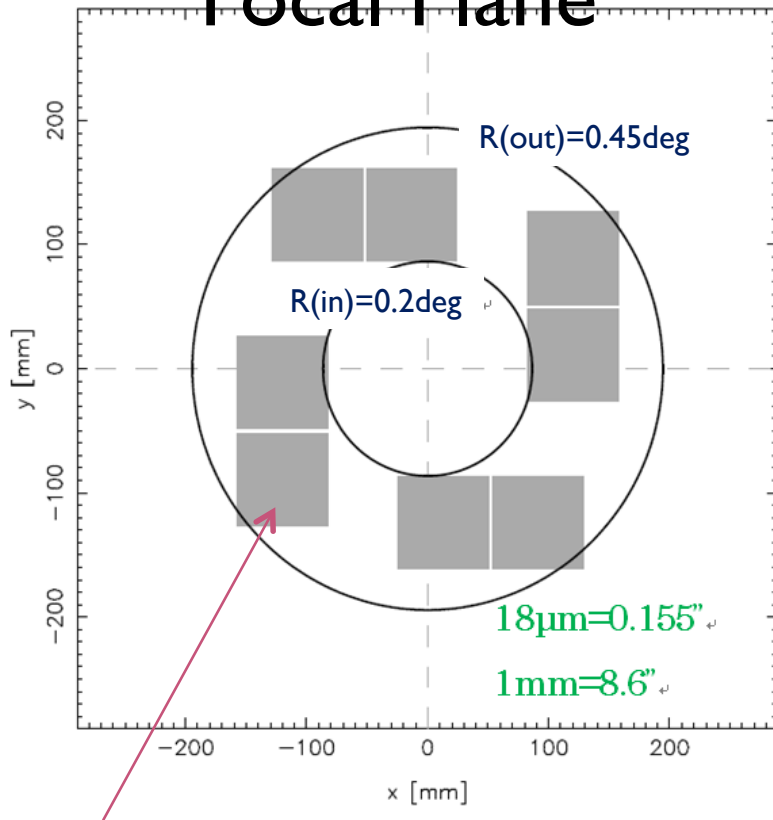
Yuji Ikeda et al.  
(photocoding)



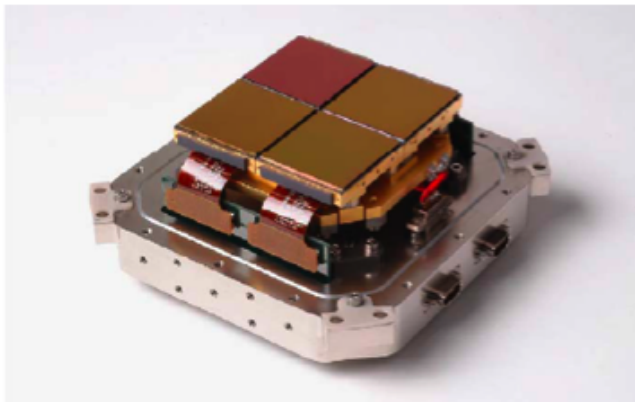


# Diffraction Limited Image at 1-5 $\mu\text{m}$

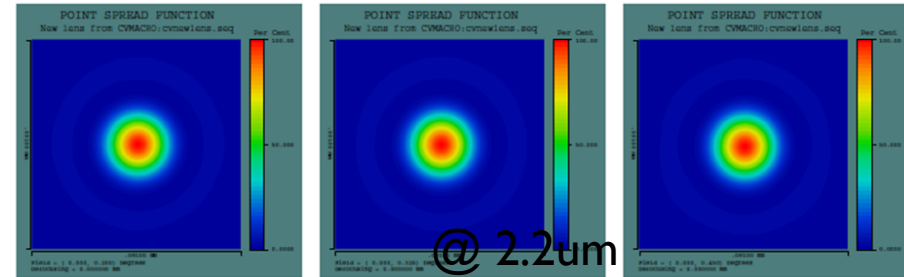
## Focal Plane



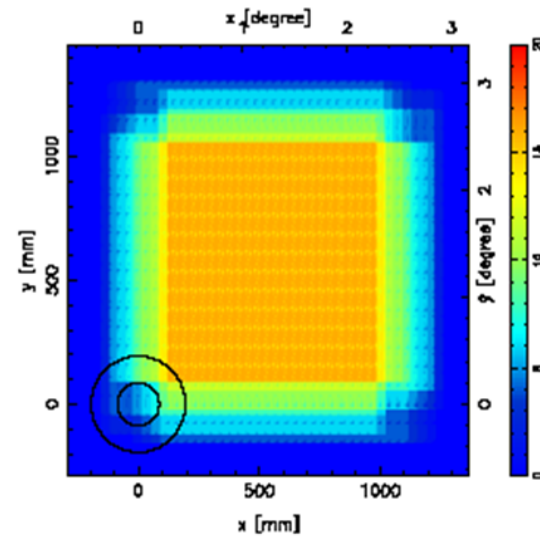
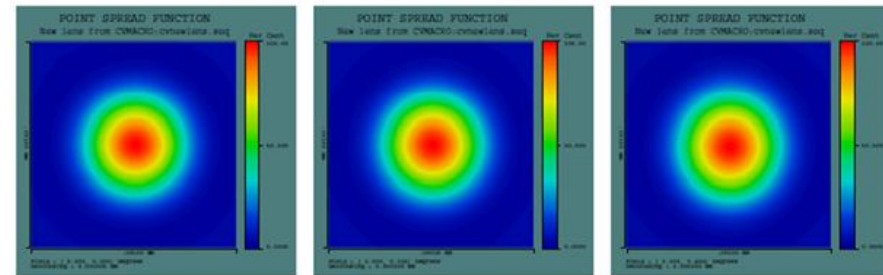
4 x 2kx2k FPA



$R=0.2, 0.325, 0.4^\circ$  @  $1.25\mu\text{m}$

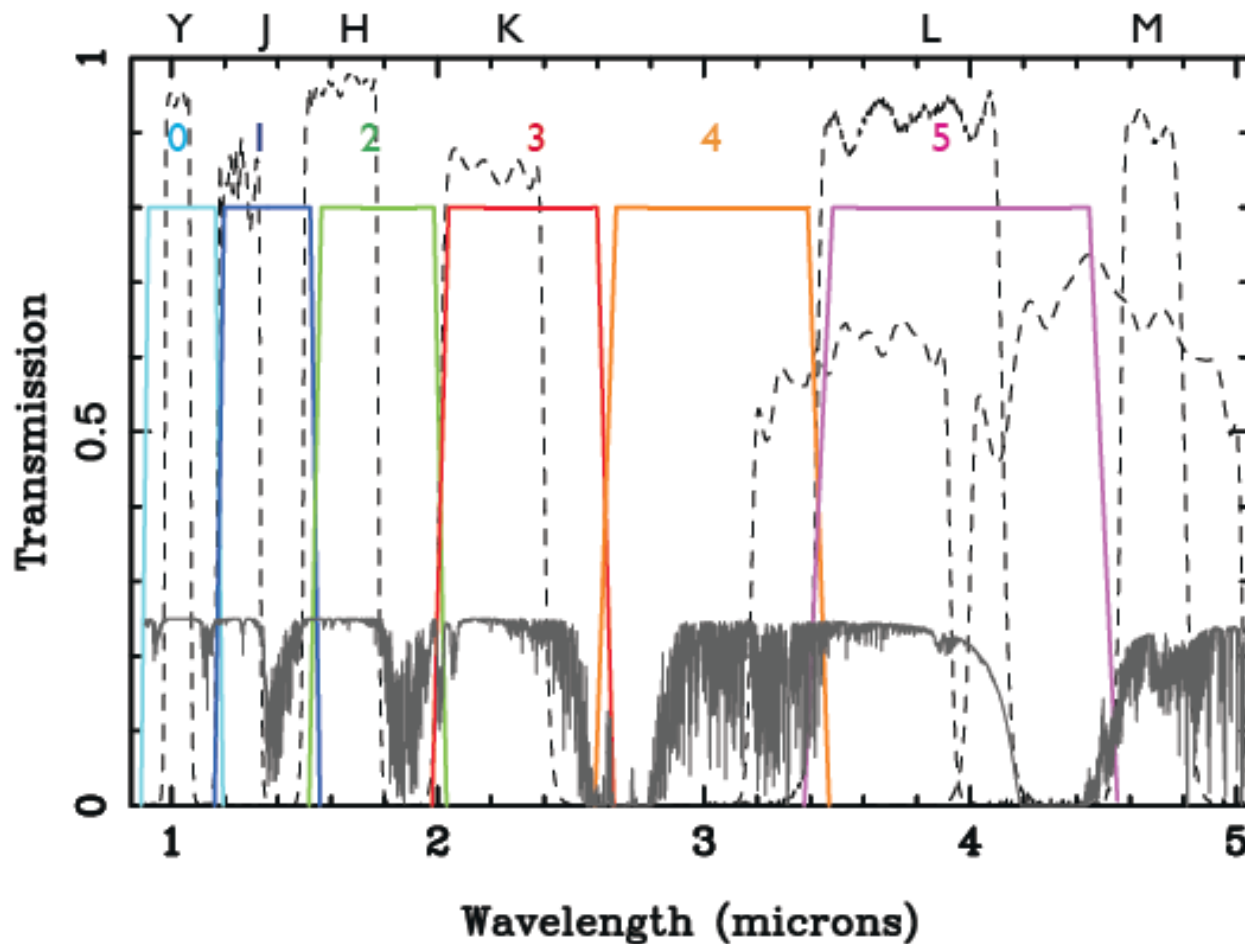


$R=0.2, 0.325, 0.4^\circ$



# WISH: Survey Strategy

set of **6 broad-band filters** + 5 custom filters



# WISH: Survey Strategy

## A Base-Line Survey Plan

|                            | Depth ( $3\sigma$ )<br>(AB mag) | Area                  | Example of the Filters<br>(a plan, to be determined) |
|----------------------------|---------------------------------|-----------------------|------------------------------------------------------|
| Ultra Deep Survey<br>(UDS) | 28                              | 100 deg <sup>2</sup>  | 1.0, 1.4, 1.8, 2.3, 3.0<br>μm                        |
| + Filter 5                 | 28                              | 10 deg <sup>2</sup>   | 4.0μm                                                |
| Ultra Wide Survey<br>(UWS) | 24-25                           | 1000 deg <sup>2</sup> | 1.4, 1.8, 2.3                                        |
| Extreme Survey             | 29-30                           | 0.25 deg <sup>2</sup> | 1.0, 1.4, 1.8                                        |

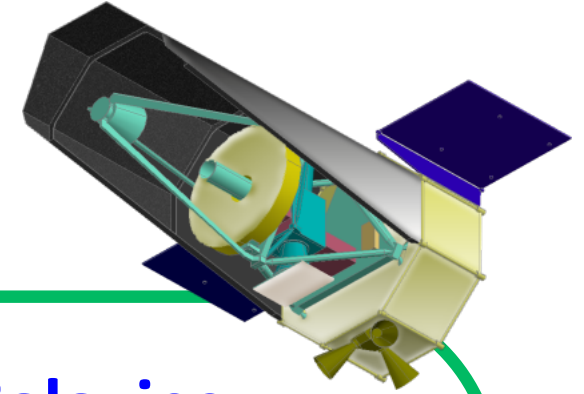
UDS 1500 days (with 50% overhead)

UWS 50-60 days Filter5 150 days

ExS 20 days/FoV

Nominal 5 Years

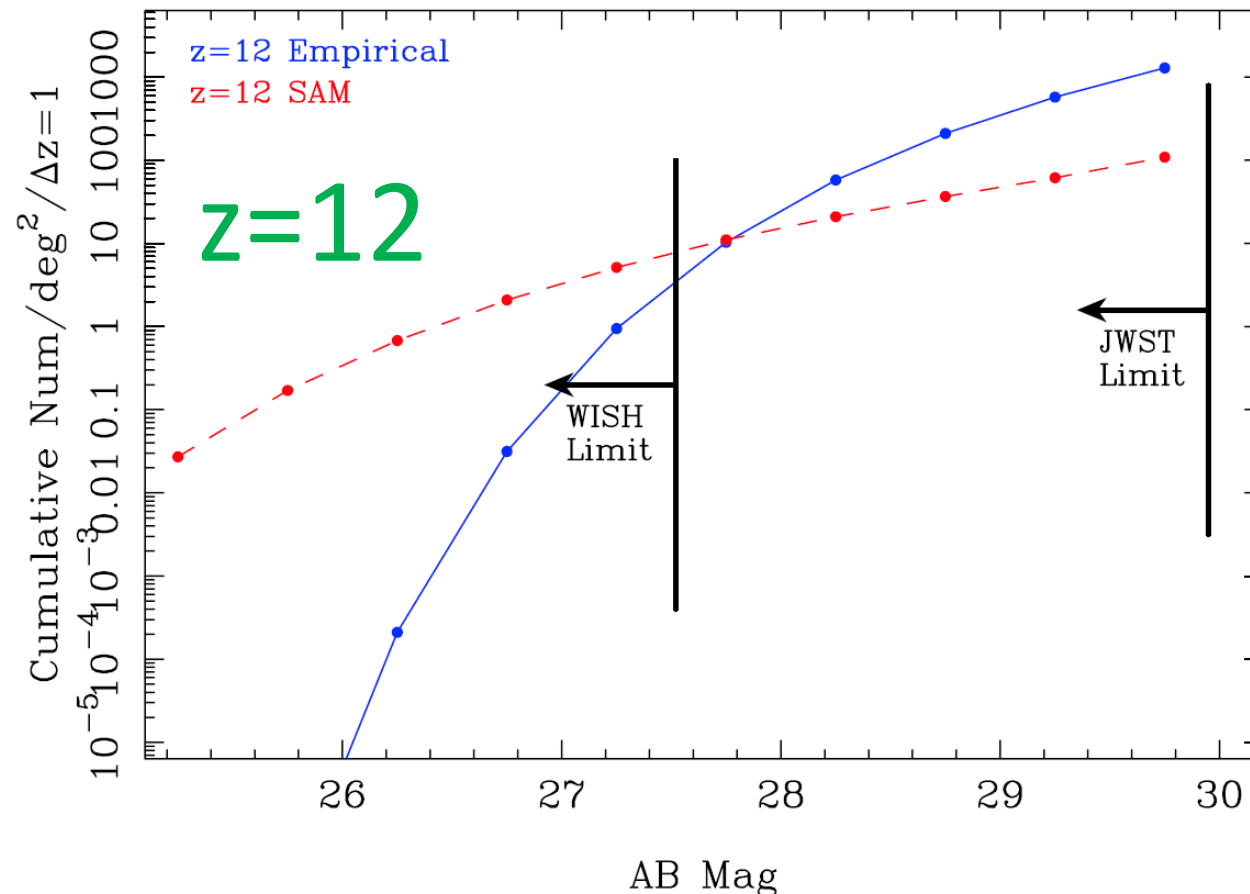
# WISH Science Goals



- **Exploring the Ultimate Frontier of Galaxies**  
Detection of 1<sup>st</sup>-generation galaxies and studying cosmic reionization over  $z=7-15$
- **NIR search and light curves for SNe Ia**  
History of cosmic expansion and Dark Energy
- Transients: high- $z$  GRB, luminous SNe
- Huge statistics and New discovery



# In the observers' frame...



Limit of  
AB>27-28 is  
needed

—  
Empirical  
luminosity evolution

- - -  
Semi-analytic  
Model prediction

FoV JWST NIRCам 2.2'x2.2' x 2ch (per filter)  
~ 2.8x10<sup>-3</sup> deg<sup>2</sup>

~10<sup>4</sup> galaxies at z=8-9,  
~10<sup>3-4</sup> galaxies at z=11-12,  
~50-100 galaxies at z=14-17

# WISH SN Ia

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## Ultra Deep Survey 3-4 band AB28mag

N=10 times/year (@ $z \sim 1$  ...  $\Delta t \sim 10$  days)

→ magnitude limit: 26.8 (N=10)

**1mag margin:  $m < 25.8$  (N=10)**

|      | Rest-frame I-band                                 | Rest-frame H-band                                |
|------|---------------------------------------------------|--------------------------------------------------|
| N=10 | $z=0.2-1.6$<br>2000 SNe Ia in 22 deg <sup>2</sup> | $z=0.-1.0$<br>2000 SNe Ia in 67 deg <sup>2</sup> |

Rest-frame B-band:  $z \sim < 3$

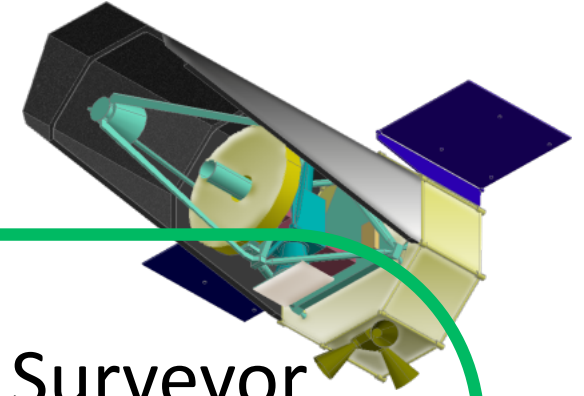
Flux calibration is a key for cosmology.

# WISH Schedule (expectation)

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| FYr                 | Items                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------------|
| FYr0<br>(2008)      | Project launched<br>JAXA/ISAS Working Group<br>Conceptual Study for Specification                           |
| FYr1-4 (2009-2012)  | Conceptual Study, R&D<br>Mission Proposal<br>Mission Requirement/Definition Review                          |
| FYr4-5              | Phase A / Proto Models                                                                                      |
| FYr5-6              | Preliminary Design Review<br>Proto Models / Test                                                            |
| FYr7-8              | Proto Models /Test<br>Critical Design Review<br>Primary Mirror / Detector fabrication start<br>Flight Model |
| FYr9                | Flight Model / Test                                                                                         |
| FYr10<br>(NET 2018) | Flight Model / Test<br>Launch                                                                               |

# Summary



- NIR Deep and Wide-field Imaging Surveyor
- 1.5m aperture, 0.15"/pix
- Exploring the 1<sup>st</sup> generation galaxies
- Dedicated,  $\sim 100 \text{ deg}^2$ , 28AB ( $\sim 25 \text{ nJy}$ )
- $\sim 10^4$  galaxies at  $z=8-9$ ,  $\sim 3-6 \times 10^3$  at  $z=11-12$ , and  $\sim 50-100$  galaxies at  $z=14-17$
- Variety of science with deep NIR Survey
- $>1000$  SNe Ia at  $z \sim 1$  discovered.
- Concept developed under JAXA/ISAS WG to be launched in late 2010's