It has long been obvious that an exoplanet mission based on a high altitude balloon is the next logical step in NASA’s quest to explore Earthlike planets. PICTURE C consists of two conventional balloon flights in a phased development plan to minimize development risks. The first flight builds on instrumentation developed in the PICTURE program and develops a high performance clear aperture telescope while the second flight adds a state of the art detector and coronagraph.

Flight one
In its first flight PICTURE C will demonstrate our existing fine pointing system in conjunction with the WASP gondola. It will develop a 0.6 meter clear aperture balloon-borne telescope and low order wavefront control while delivering high value science results. By using the coronagraph, fine pointing system, high order wavefront control, and detectors developed for PICTURE (see 220.10), we minimize development risk.

Flight two
A number of technologies have been developed under NASA funding and await flight testing; this effort will move them from ground based telescopes to flight systems. Flight two will provide a flight demonstration of a high performance Vector Vortex Coronagraph (image below from Mawet et al., 2011) and raise the TRL of an integral field detector, the MKID (image at top from Mazin et al., 2013). Using these technologies we enabling high contrast (10$^{-1}$) imaging in four bands.

The best measured power spectrum of the WASP pointing (orange line; James Lanni, private communication) is limited by the sensor noise floor at all frequencies above $\sim$ 1 Hz. In order to estimate our pointing performance we have assumed the a high frequency roll off similar to that seen in PICTURE (black line). This is physically reasonable based on the payload’s moments of inertia. A key result of flight 1 will be the higher frequency measurement needed to accurately model the pointing system performance.

The images to the right, made using ZODIPIC (Kuchner, 2012), show the PICTURE C flight two capabilities. We have simulated a 1R$_{J}$ planet around $\alpha$ Aql (top), a small (20 zodi) dust disk around $\gamma$ Cet (middle), and a large one (100 zodi) around $\epsilon$ Eri (bottom). These simulations are not meant to show an actual planet or dust distribution but rather to highlight our capabilities; the instrument scan detect $\leq$10 zodi disks. These simulations use HCIT data (Greaves et al., 1998) ring around $\epsilon$ Eri.

The primary objective of PICTURE C is to image debris disks and exosolar light around at least five stars, including $\epsilon$ Eri, $\alpha$ Lyrae, $\alpha$ Aql, $\sigma$ Draconis, and $\gamma$ Ceti. They have been selected because they are nearby, span a range of infrared excesses, stellar types and ages, and are positioned so that the observations can progress throughout the night.

Undergraduates
Undergraduates have always played a key role in the suborbital program, to our mutual benefit. They are involved in both our research programs and in dedicated student education launches. For the SPECTRE student launch (above), a team of students proposed (and won) the project, designed the experiment, built the hardware, integrated it with the launch vehicle, and analyzed the data recorded during flight.

Graduate Students
The suborbital program has trained PhD students for careers in academia, government, and industry. The low cost program allows the to gain hands-on experience.

The NASA suborbital program, in general, and the PICTURE C program, in particular, have a strong commitment to training students and young professionals at all levels—from elementary school students to graduate students—a point of emphasis in the NASA 2010 Strategic Plan.

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