

# BIOPHOTONICS

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## WHITE PAPERS & APPLICATION NOTES



### Product Development Strategies for Electro-Optical Systems - Fail Fast vs. Moonshot

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#### Part I

If you work in product development you've heard the mantra "fail fast, fail early, fail often", or similar. It's a good goal, and great when building digital software products, where iteration may take a matter of minutes or even days. However, how effective is this strategy in optical product development where custom optical components regularly exceed 12 week lead times and tens of thousands of dollars? An 3D printer needs for precision optics (3D).

One might contend that with the "moonshot" approach - when you may have one chance for a successful product launch (literally) in space borne systems, it is common to spend years on design and analysis, modeling, simulation, and build and test. For example, the James Webb Space Telescope took roughly 18 years of active development.

In our capacity as a product development firm, Optikos routinely encounters these two extremes and every permutation in between. In every project we find ourselves guiding our customers through the unique challenges of optical product development, and working together to optimally balance the holy trinity: schedule, cost, and performance.

Let's look at the unique challenges associated with optical systems by making two extremes, an ultra-high precision instrument, and a low-cost consumer product. In this Part I we'll discuss the high-end instrument, in Part II we'll explore the low cost product.

Aspects of a program in the life sciences our customers usually have already used a microscope platform to prove out their biology and/or chemistry. In these cases, there is limited value in cobbling together an optics prototype with COTS parts as performance will rarely reflect the final product.

For alpha prototypes, we recommend avoiding the necessary and schedule constraints to procure high-quality optics from a reputable supplier. Trying to save money by going overseas or routing parts will often result in costing more in the long run.

As it goes you've spent a lot of money and time to build a prototype - isn't it tempting to jump straight to that production? After all, we've worked out all bugs during Alpha, right?

Unless you've thoroughly validated your design, this is a trap. Move to pilot only if you are well-financed and prepared to substantially rework your pilot units, as the longer this may be more costly than understanding a product before a prototype build. We do understand that schedule pressure sometimes requires a leap of faith.

Focus on cost-reduction in production and after identifying reliable, high-quality optical vendors takes time and careful vetting. Our recommendation for high performing optical systems is to focus on a reliable vendor for 50 weeks or overseas and then explore cost-reduction in parallel with production build. You always want a known-good vendor to fall back on.



#### Precision Instrumentation with Custom Optics

An entire area of stable growth for optics is research and analytical instrumentation. Optikos regularly works on custom fluorescence or microscopy systems - both are high-performing systems with either severe signal limitations (fluorescence) or very high-resolution requirements (microscopy). In both cases, this leads to high-quality optical and opto-mechanical systems.

A common development strategy is to use commercial off-the-shelf parts (COTS) or commercial necessities to de-risk

to minimize risk for high-performance optical systems.

- Use commercial off-the-shelf (COTS) parts to strategically broadband the filter.
- Spend the time to fully develop product requirements, design against those requirements.
- Use custom parts for prototype - spend the money for a reliable vendor and known-good parts.
- Due to lead time it is tempting to skip a 2nd prototype and go straight to pilot - this will be avoided.

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