Title	Kinkajou Redesign: Driving Principles
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Some major drivers behind the design were:

- Follow the principles behind axiomatic design
    - Achieve various functional requirements through independent means
        - E.g. separate the process by which we load microfilm (FR 2.1) and the process by which we present the microfilm to the desired location (FR 2.2)
    - Independence allows greater design freedom because independence reduces coupling
    - See included document which summarizes axiomatic design
- Minimize tight tolerances for manufacturing
    - Minimize the number of parts that have to be toleranced tightly to preserve optical path
    - Where tight tolerances are required: it is easier to position and drill holes for pins than it is to position, drill, and tap holes for screws
        - Good machinists can create very tightly tolerances parts, but tight tolerances require care and increase the risk of scrapping parts!
        - For mass produced parts, I would not specify positional tolerances for holes tighter than +/- 0.01" (maximum material condition)
        - For mass produced parts, I would not specify positional tolerances for tapped holes tighter than +/- 0.03" (maximum material condition)
    - Kinematic mounts achieve accurate positioning without reliance on tightly toleranced tapped holes. We can achieve this with two methods:
        - 1 pin in a hole (controls position) and another pin in a slot (controls clocking)
        - 1 pin in a hole (controls position) and "diamond" pin in another hole (controls clocking). Diamond pins can be purchased just like regular pins.

Some thoughts on the proposed design

- Projector is sealed with ~ no openings to outside
    - Exception is opening for cabling, which should be strategically placed to minimize threat from dust. Use grommet to protect cabling from chassis' rough edges
- Chassis assembly
    - Main housing can be made through sand casting or with sheet metal. We prefer sand casting approach. Metallic housing facilitates cooling because convective area is maximized.
    - Tapped holes accommodate threaded inserts (not shown in CAD model). Aluminum threads can be easily ruined if debris enters. Thus, threads that

are used frequently (e.g. for attaching lid assembly) should not be made from aluminum.
    - With sand casting, post-machining is required to:
        - eliminate draft angle on wall where LED attaches
        - provide smooth surface finish to promote conductive heat transfer
        - drill holes for alignment pins
        - drill and tap holes for fastening the LED
    - With sand casting, we can actually eliminate the green part
        - The green part is only required for the sheet metal approach
            - Sheet metal thickness is not sufficient to secure pins.
            - Green part provides additional features to sheet metal box for attaching LED
        - With sand casting, we can increase wall thicknesses locally and provide features for LED mounting
        - Bottom line: by using a sand casting, we can eliminate the green part and actually simplify the tolerance chain!
        - Note: the solidworks CAD file was made when we were assuming a sheet metal approach. Thus, given more time, we would have eliminated the green part in the CAD model.
    - The alignment pin on the current green part positions the lid assembly.
        - The mating feature on the lid assembly should incorporate a cone to facilitate mating
        - We should ensure that the mating feature on the lid assembly does NOT bottom out on the chassis itself. We want the vertical placement of the lid assembly to be controlled by the walls of the chassis. (If the mating feature bottomed out on the chassis, we would bend the lid assembly as we fastened it to the chassis walls)
        - The alignment pin on the chassis wall controls the clocking of the lid assembly.
        - With a sand casting, these pins would be inserted into locally thickened areas.
    - The heat convection fins are purchased separately and bolted onto the back of the chassis
    - Conductive epoxy or conductive tape can be used to promote thermal conduction between
        - the LED and chassis
        - the chassis and the fins
    - Focus lens:
        - Has a feature that is threaded (for focus adjustment)
        - Has a retaining ring to ensure the focus lens can not be inadvertently screwed off the chassis assembly
        - Is recessed within chassis assembly for protection
- Lid assembly
    - Promotes easy installation of microfilm
    - Guide keeps film flat near optical path
    - Ball detent on posts prevent microfilm reels from falling off lid

- Microfilm reels should be elevated off the lid itself via a short cylindrical boss. Elevating the reels will reduce friction between the reels and the lid.
- Each post is attached to a “crank” on the outside of the lid. Therefore, we would turn one crank to advance the film and the other crank to rewind the film. The two cranks are not attached via a belt or other external mechanism.