Canard Electric Nose Lift Systems

EZNoselift Clamp & New EGP System

Marc J. Zeitlin

June 1st, 2024

1430 (2:30 PM)

Columbia Airport (O22) Campground Mess Hall

What Will I Talk About?

- ***My Background***
- ***Previous Nose Lift Types***
  - ***Manual***
    - ***Johnson Bar***
    - ***Crank (Brock)***
  - ***Electric***
    - ***EZNoselift (Jack Wilhelmson)***
    - ***Wright Nose Lift (Steve Wright)***
    - ***Emons Nose Lift (Jim Emons)***
    - ***Aerocad Nose Lift (Jeff Russell)***
- ***EZNoselift Clamp System***
  - ***Issues with EZNoselift***
    - ***Wobble, Ball Screw Breakage, Alignment Groove Wear, Broken Gears, Microswitch mounting, etc.***
    - ***Side Clamp Bolt Loosening, Bending, Falling Out***
  - ***Clamp System Fix for Attach Bolts***

- ***New EGP Nose Lift System***
  - ***Manual / Electric Nose Lift History***
  - ***My Goals***
  - ***EGP System Description***
  - ***Documentation Created***
  - ***System Advantages***
  - ***System Disadvantages***
  - ***Electrical System Plans***
  - ***My Experience***
  - ***Order Status - Future Vendor***
- ***Additional New Nose Gear Parts***
  - ***NG-2B***
  - ***MKNG-2B***
  - ***NG-5B***
  - ***NG-6B / NG-7B***
  - ***MKNG-6B / MKNG-7B***
- ***References***
- ***Questions and Answer – until done (ANY topic (and I do mean ANY)***

My Background

- Biography / Resume'
  - http://www.mdzeitlin.com/Marc/bio.html
  - https://www.burnsideaerospace.com/resume/

- Built Quickie Q2 (1980 – 1985)
- Built COZY MKIV #386, N83MZ – ~1980 flying hours
- Started / Administer Unofficial COZY Builders Web Page and COZY Builders Mailing List (~711 members)

- As **Burnside Aerospace**, provide:
  - E-AB / canard A&P services (Pre-Buy, Pre-Sale, Condition Inspection, Builder Assist, Modifications, Upgrades, Sale Assistance, etc.)
  - Consulting to multiple commercial clients re: canard composite aircraft, Design Reviews, etc.

- I provide **UNOFFICIAL** technical support for **COZY** aircraft (and other canards) to all builders, flyers and prospective builders

- Enough of that

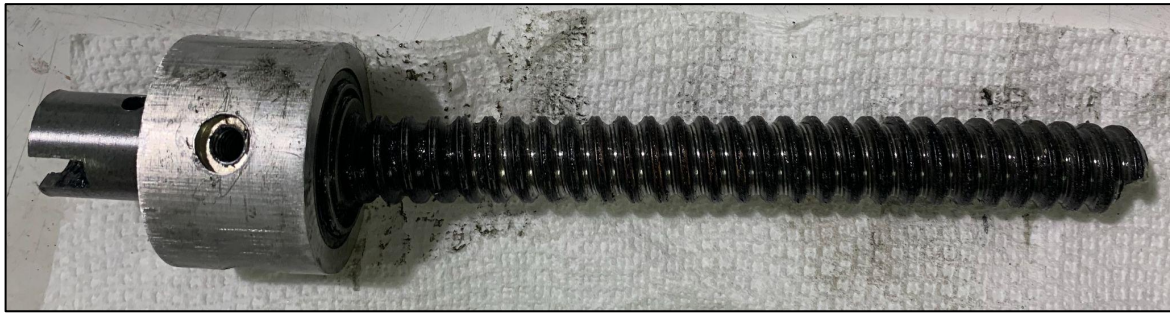
Previous Nose Lift Types

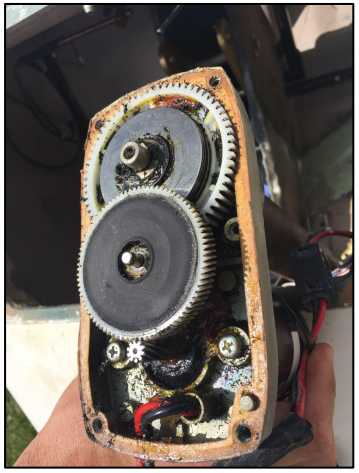
- **Manual**
  - Johnson Bar
    From Original Varieze - bar pointing at pilot's crotch (nut-buster)
  - Crank (Brock)
    Small hand crank centered on IP, torque tube to worm gear mechanism

- **Electric (All use same Thomson-Saginaw [now unavailable] Linear Actuator)**
  - **EZNoselift (Jack Wilhelmson)**
    Most common - hundreds installed. Easiest to retrofit, smallest system. Earliest systems had manual crank backup in case of electrical failure
  - **Wright Noselift (Steve Wright)**
    Next most common. Requires hole in center of F-22 bulkhead - protrudes far aft of F-22 and can interfere with center radio stack
  - **Oertel Noselift (Bill Oertel)**
    Only a few installed
  - **Emons Noselift (Jim Emons)**
    Only a few installed - very bulky, requires removal of vertical part of F-22, with reinforcements to replace. Very heavy
  - **Aerocad Noselift (Jeff Russell)**
    Very few extant. External spring cartridge - heavy, bulky

EZNoselift Clamp System - Issues

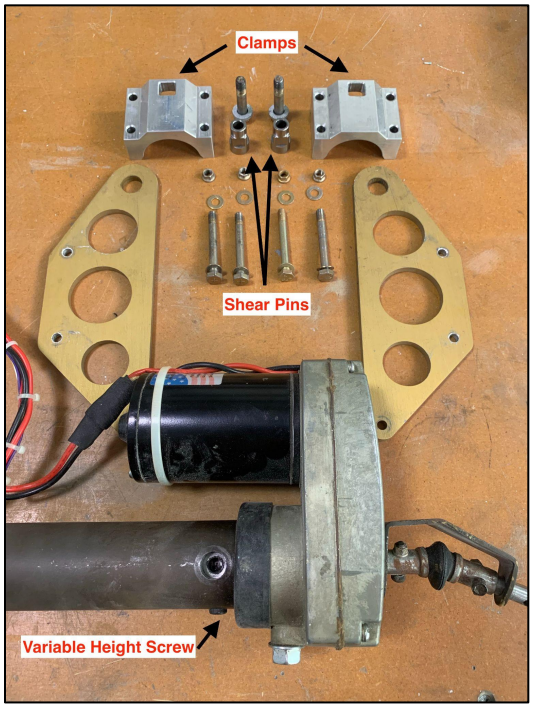
- **Issues with Old EZNoselift:**
  - Wobble, Ball Screw Breakage (**Thayer**, other)
  - Alignment Groove Wear
  - Broken Gears, Clutch Failure
  - Microswitch mounting, etc.
  - Bent NG-3/NG-4 attach bolts
  - Side Clamp Bolt Loosening, Bending, Falling Out - **MANY instances of this**
- **Issues with New EZNoselift** (don't get me started)





EZNoselift Clamp System - Partial Fix

- **Clamp System Fix for Attach Bolts:**
  - Based on Dave Ronnenberg's "Cruciform" fix
  - Doesn't need customization - fit's **all** old-style EZNoselifts (some minor modification sometimes required to account for EZNoselift MFG variability)
  - Clamps on the exterior of the upper tube and supports the shear pins so that they cannot stress, bend or deform the bolts, nor is tension on the bolts required to prevent the bolts from loosening
  - Installs in an hour or so



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  - *MKNG-2B*
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New EGP Nose Lift System

- **Manual / Electric Nose Lift History**
  - Varieze - Manual Johnson Bar (dangerous - might as well point at heart, rather than dainty bits)
  - Varieze - ManualWorm Gear w/solid pushrod
  - Varieze - Manual Worm Gear w/spring Cartridge (WTF did this come from, and why?)
  - Long-EZ - same as Varieze
  - COZY III - same as Varieze
  - COZY MKIV - same as Varieze burt with stronger spring cartridge

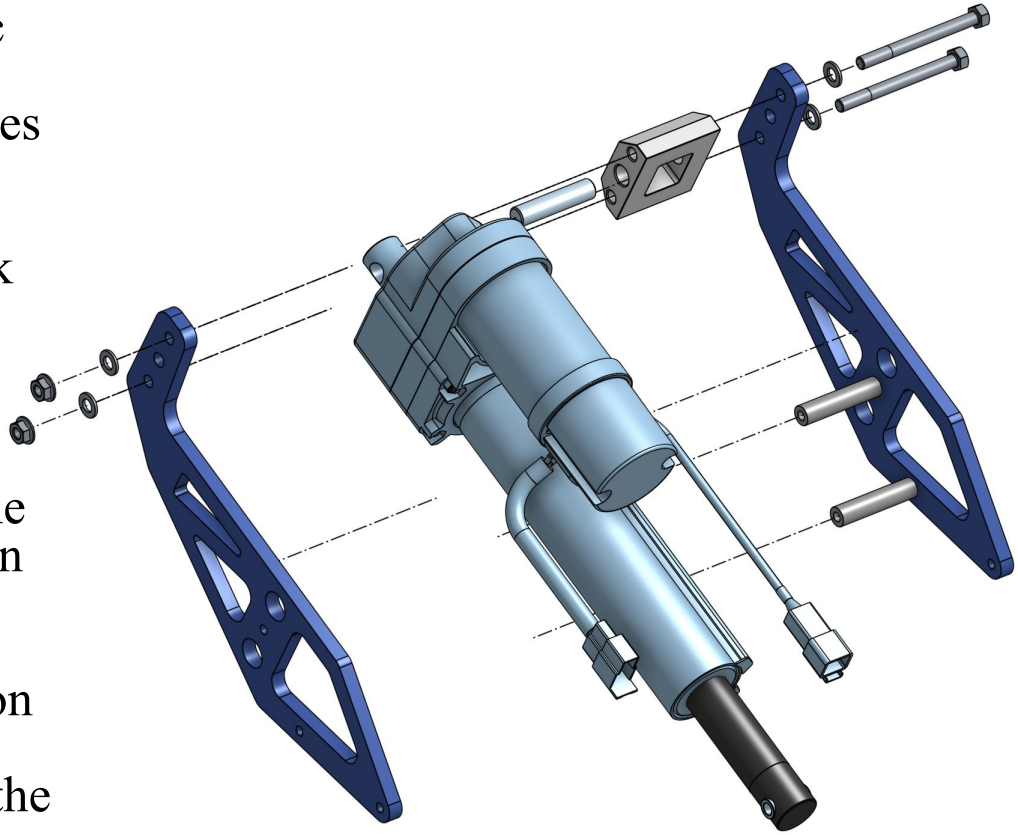
  - All the electric systems mentioned earlier developed around the same time - mid 1990's AFAIK - all use some semblance of spring cartridge of varying strengths
  - Hasn't been a wholly new system in 25 - 30 years
  - "New" EZNoselift uses new actuator and new belt drive system with same EZNoselift spring cartridge

New EGP Nose Lift System

- **My Goals**
  - Drop in replacement for existing Mechanical or Electric systems
  - Minimize / eliminate mechanical modifications to the F-22 bulkhead
  - Minimize / eliminate mechanical modifications to NG-30 structure
  - Allow for simple retrofit
  - Minimize the changes to the design for new builds
  - I was able to retrofit my COZY MKIV, which started with a stock manual system and then had an EZNoselift (classic) system for about 20 years, in a few days, including the electrical modifications

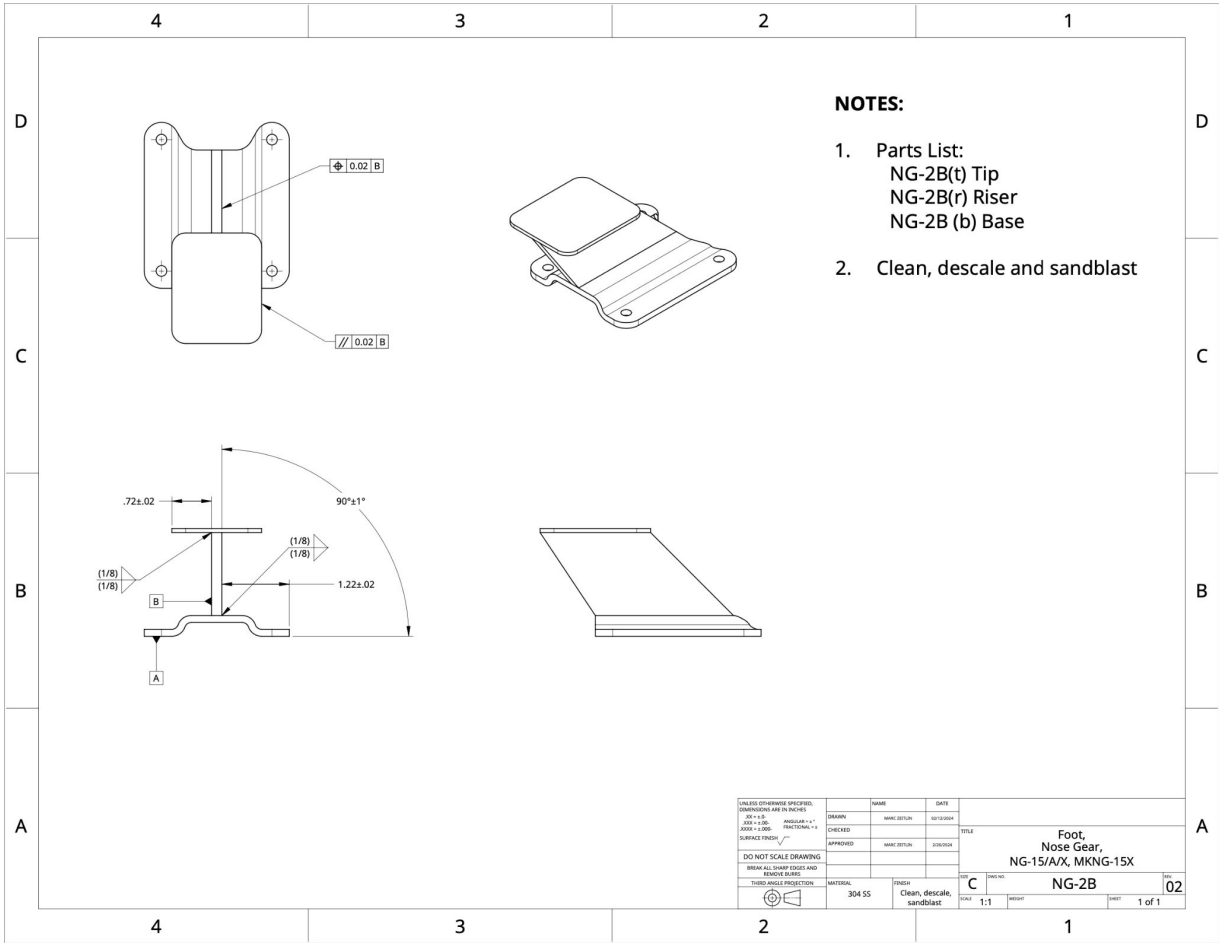
New EGP Nose Lift System

- **EGP System Description**
  - **OTS** (**O**ff **T**he **S**helf) electric linear actuator with integral easily adjustable limit switches
  - New NG-30 side attachment plates and spacers
  - New actuator mounting block & mounting block pin/bolts
  - New NG-3B & NG-4B brackets
  - Fits completely forward of the F-22 bulkhead and in between the outer surfaces of the NG-30s
  - Requires no F-22 modification or hole
  - Requires no modification to the two or three side plate mounting holes in the NG-30s
  - Electrical drive board / wiring harness



New EGP Nose Lift System

- **Documentation Created (EGP and other nose gear components)**
  - 3D Models of ALL components **STEP** models, used by online manufacturers for product definition
  - 2D Drawings of ALL components **PDF** files, used to specify non-geometric component specifications (using **GD&T** terminology for precision)



New EGP Nose Lift System

- **System Advantages**

  - **New OTS Actuator**:
    - No actuator modifications required or performed, therefore no weak points from machining or welding as with existing actuator systems
    - Will be available for many years, as is used in varied industrial equipment

  - **No Spring Cartridge:**
    - Causes far more problems than it solves (if it solved any).
    - Allows for extremely hard braking on short runways or in emergency situations without any danger of nose gear steering axis angle inversion and extreme shimmy
    - Eliminates the "porpoising" action of the nose of these aircraft when taxiing over bumps or dips, which can find resonance and lead to tipback or prop strikes, aside from merely being annoying and scary to passengers
    - Numerous examples of aircraft with the original VE manual gear - Ryszard Zadow Varieze; Mehran Salamati's Berkut(s), Many others who've operated safely

  - **Limit switch adjustment:** Adjusting the limit switches in the OTS actuator is very simple - switches are protected with no connectors between them and the actuator

  - **Weight:** Approximately the same weight as existing electric actuation systems
  - **Cost:** Guaranteed to be equal to or lower than existing, available nose gear retraction systems - ~$2500 total

  - **Eliminated Issues :**
    - Loose/bent side plate attachment bolts
    - Wobbling extension shaft due to poor welding alignment of ball screw shaft
    - Grinding of bottom of actuator to clear NG-4 interior surface
    - Wallowing of NG-3/4 mounting holes due to using bolt as the bearing member
    - Plastic drive gear & clutch breakage
    - Poor / non-existent technical support
    - Modifications to NG-30s and/or F-22
    - Acme Screw drive will NOT backdrive under load

New EGP Nose Lift System

- **System Disadvantages**
  - **No Spring Cartridge:** if you like it, not having one is a disadvantage
  - **No Mechanical Extension:** As with most (if not all) of the currently available nose gear systems, no manual extension crank is possible - only an electric backup in the case of aircraft electrical system failure is possible. Schematics/electrical board provisions for electric backup extension are provided
  - **1,500 lb. Load Limit:** Systems using Thomson Saginaw Ball Screw mechanism had a maximum load capability of approximately 3,000 lb. at the mechanism. This was required to lift a MGW, forward CG COZY MKIV from a grazing position to a fully extended position (bumper on the ground is the worst case load). Without major modifications to F-22 I was not able to fit an electric actuator that had a 3,000 lb. load capability and I was not willing to force holes or modifications to F-22

    With the new system's 1,500 load capacity, you will be required to electrically lift the nose to 18" - 24" off the ground before loading the front seat (the amount of load will determine required height - these #'s are approximate)

    Since raising a fully loaded aircraft from the ground is contraindicated due to the fact that the NG-1L strut was **not** designed for such loading, I believe that the advantage of not having to modify the aircraft structure outweighs the disadvantage of having to raise the nose prior to front seat loading, but this is a disadvantage

New EGP Nose Lift System

- **Electrical System Plans**
  - Working with Trevor Howard (E.E.)
  - Designing small drive circuit board with all relays, connectors and wiring harness
  - IP Switches specified
  - Tested to > maximum current capability
  - Options for Backup electrical extend with backup battery and backup extend switch
  - Option for Auto Extend input via discrete or EFIS drive
  - Included in system cost

New EGP Nose Lift System

- **My Experiences**
  - System installed for 4 months (also using 3:23 Composites new NG-15X Fork System)
  - Excellent steering response - steeper steering angle achievable
  - **NO** nose dip on braking
  - **NO** porpoising while taxiing over dips or bumps due to spring cartridge resonance / no damping
  - **SLIGHT** grinding of inner corner of F-22/NG-30 required
  - **SLIGHT** filing of top aft corner of side plates to clear F-22/NG-30 corner (these two will be dependent on specifics of radii in corner)

  - Although actuator claims to use up to 20A when stalled, I've never been able to get it to pop a 15A fuse
  - Testing of lifting nose with weight in front seat indicates that internal clutch will slip if overloaded, giving notice of overload (still no fuse pop)
  - Still need to test final electrical drive circuitry
  - Extremely happy with system so far - hope to install in 2nd COZY MKIV before July

New EGP Nose Lift System

- **My Experiences**
  - NG-3B / NG-4B installation on NG-1L, following Joe Polonek's basic procedure for trapping brackets (prior to strut cover installation)
  - 5/16" bolt usage for robustness
  - Match drilled NG-3B & NG-4B
  - MKNG-6B / NG-5B pivot and clamp
  - NG-2B used with 3:23 Composites NG-15X COZY MKIV fork

New EGP Nose Lift System

- **Order Status / Future Vendor**
  - **Order status:**
    - Currently have 35 system orders from 34 customers @ $2,500 / system
    - All parts other than actuators are in-house
    - Actuator deliveries expected mid-June to mid-July (working on vendor delivery issues - 14 week promised lead time extended to 17 weeks - trying to pull back in)
  - **Future Vendor:**
    - I don’t want to be in the MFG/Sales business
    - Working with existing canard component vendor to take over MFG and delivery of **all** new nose gear components and systems - hopefully will happen in the fall

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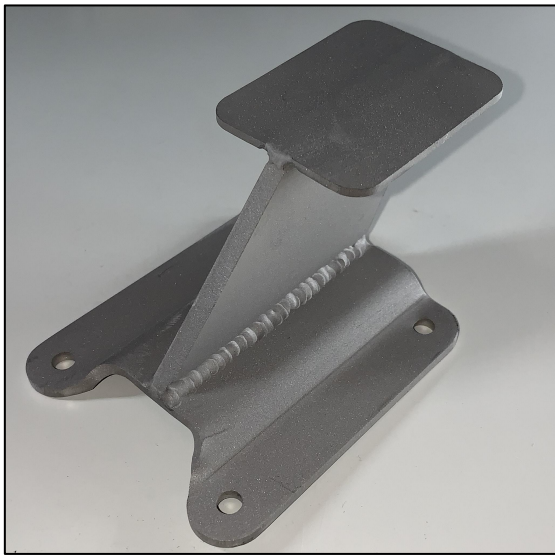
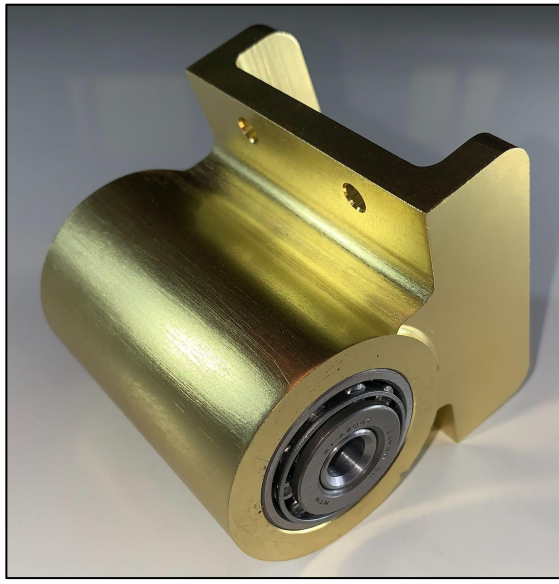
Additional New Nose Gear Parts

- **NG-2B**
  - High quality welding to weldment specifications
  - Thicker base - eliminate bending
  - Clearance for full 360 degree nose wheel steering rotation
  - Sand blasted for aesthetics



- **NG-3B &**
- **NG-4B**
  - as seen on previous slides
  - precision bent
  - thicker material for robustness
  - match drilled holes

- **NG-5B**
- **NG-6B / NG-7B**
- **MKNG-6B / MKNG-7B**
  - Pre-drilled <n>-6B
  - Match drilled NG-5B
  - NG-7B uses two bolts - no need for hole in fuselage side in Varieze or Long-EZ



References

- ***Burnside Aerospace Nose Gear Web Page***
  - ***https://www.burnsideaerospace.com/nose-gear-system-info***
  - *All documentation for **EZNoselift Clamp System** and all EGP Nose Gear systems & components available*
- ***EZNoselift Web Page***
  - ***http://www.eznoselift.com/***

Any Other Damn Thing / Questions & Answers

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- Websites: http://www.cozybuilders.org
  http://www.burnsideaerospace.com