NOTES:

1. This design won a Bronze medal in the 2014 FAI World Championships flown by Trip Barber. The design was developed by Keith Vinyard.

2. At the time of this publication, this design is the state of the art generally used by the USA FAI team in international competition.

3. These plans describe building the gyrocopter assembly shown. They do not include instructions on building an FAI style fiberglass body tube.
Hub Assembly

Hub Assembly Instructions:
1. Glue hinges to bottom plywood bulkhead using cyanoacrylate.
2. Glue the top plywood bulkhead to the hinges using epoxy.
3. Glue aluminum spacer through the assembly using epoxy.
4. Glue balsa pieces to hinges.
5. Do not glue music wire hooks to balsa until blades are glued to the hub.
6. After blades are installed, the music wire hooks are pushed through incidence stops in the hub.

The incidence will be adjusted during trimming to ensure a dihedral angle of 10 deg.
Hub Assembly

1/64 in. birch plywood bulkhead

Small Nylon Hinge
(modified by cutting to length)

Aluminum spacer tube

Incidence stop
(made of balsa)

Rubber Band Hook
(made of music wire)
Small Nylon Hinge
Quantity = 3
Hinges are Klett model airplane hinges, which are commercially available.

Cut hinge to fit Hub Assembly

Plywood Bulkhead
Quantity = 3
Make from 1/64 in. birch plywood

Quantity = 3
Cut from Nominal 3/32 in. aluminum tube

Aluminum Spacer
Quantity = 2
Only one spacer used for Hub Assembly
Cut from 3/32 in. medium density balsa

Quantity = 3
Cut from 3/32 in. medium density balsa

Scale = 3:2
Unless otherwise noted
Dimensions are in. [mm]

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Drawing Title: FAI A Gyrocopter 2018 (S9A)
Drawn By: Doug Hillson NAR #61624
Checked By: Trip Barber NAR #4322
Revision: Rev 1
Release Date: 8/25/18
Nose Assembly

Nose Assembly Instructions:
1. Glue aluminum spacer tube into Styrofoam bulkhead using epoxy.
2. Glue plywood cap on aluminum spacer and bulkhead using epoxy.
3. Glue 0.030" carbon rod rotary shaft into nose assembly using epoxy.
4. Glue fiberglass shoulder onto Styrofoam bulkhead.
5. Glue nose cone onto assembly using epoxy.
Nose Assembly

- **Nose Cone**
  - At time of publication
  - Part # 20061
  - Available from Apogee Components

- **Nose Bulkhead**
  - Quantity = 1
  - Make from Styrofoam
  - Must be a snug fit in fiberglass shoulder

- **Nose Shoulder**
  - Quantity = 1
  - Make from fiberglass or card stock
  - Must be a snug fit in body tube
  - If made from fiberglass, use a mandrel with an OD of 39.7 mm

- **Spacer Cap**
  - Quantity = 2
  - Make from 1/64 in. plywood

- **Aluminum Spacer**
  - Quantity = 2
  - Only one spacer used for Nose Cone Assembly
  - Cut from Nominal 3/32 in Aluminum Tubing

- **Nose Shoulder**

- **Nose Bulkhead**
  - Quantity = 1
  - Make from Styrofoam
  - Must be a snug fit in fiberglass shoulder

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Scale = 2:3

Dimensions are:

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<td>Drawn By</td>
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Nose Assembly

Rotary shaft glued to aluminum spacer

Completed Nose Assembly
View is cropped

Assembly View
View is cropped
Nose cone not shown for clarity

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Dimensions are: in. [mm]
Blade Construction

Blade Instructions:
1. Cut out blades from lightweight 4 to 6 lbs. 1/32 in. balsa and sand smooth.
2. Wet the blades with ammonia.
3. Tape the blades into position on an FAI-1 (5 deg taper) FAI mandrel. All three blades can be formed at the same time.
4. Tightly wrap an elastic medical band around the three blades and the mandrel.
5. Let the blades dry for 24 hours.
6. Remove the blades and apply finishing epoxy to the last ~25 mm of each blade - this is to prevent blade damage at ejection.
Gyrocopter Blade Planform
Quantity = 3
Make from 1/32 in. lightweight 4 to 6 lbs. balsa
View is a scale of 4:5 (Enlarge drawing to 125%)
The pitch angle of the blade at maximum chord is approximately 9 deg. The pitch angle at the tip is approximately 0 deg. This is as viewed from the tip toward the center of rotation.

The change in pitch angle should result automatically due to the geometry and construction method.
Finally Assembly Instructions:
1. Glue blades to hub assembly.
2. Insert music wire hooks through the blades and hub assembly and glue with cyanoacrylate.
3. Insert 6 small orthodontic rubber bands on the rotary shaft of the nose cone assembly before placing the hub on the shaft. Use one per blade (3 spare).
4. Insert aluminum spacer onto rotary shaft and glue with cyanoacrylate with the top of the spacer approximately 22 mm from the bottom of the nose cone shoulder.
5. Reinforce the spacer glue joint with nylon thread and smear cyanoacrylate on the threads.
6. Glue shock mount hook to end of rotary shaft using epoxy and cyanoacrylate covered nylon thread.
Rubber Bands
1 per blade

Dihedral Angle 10°

Hub should rotate freely around the rotary shaft

Rotary shaft
Quantity = 1
Cut from 0.03 in. nominal carbon fiber rod
Length = 15.6 in.

Length should ensure the shock cord mount is flush with blade tips when blades are folded.

Shock cord mount
Glue to the rotary shaft and reinforce glue joint with nylon thread

Glue aluminum spacer to rotary shaft and reinforce with nylon thread

Back blade not shown for clarity

Scale = 1:2
Unless otherwise noted
Dimensions are:
in. [mm]

Gyrocopter Assembly

Scale = 3:1

Rubber Bands
Quantity = 1
Make out of 0.025 in. dia. music wire

Shock cord mount

Gyrocopter Assembly

Scale = 1:1

DETAIL A

Rubber Bands
1 per blade

Dihedral Angle 10°

Hub should rotate freely around the rotary shaft

Rotary shaft
Quantity = 1
Cut from 0.03 in. nominal carbon fiber rod
Length = 15.6 in.

Length should ensure the shock cord mount is flush with blade tips when blades are folded.

Shock cord mount
Glue to the rotary shaft and reinforce glue joint with nylon thread

Glue aluminum spacer to rotary shaft and reinforce with nylon thread

Back blade not shown for clarity

Scale = 1:2
Unless otherwise noted
Dimensions are:
in. [mm]

Gyrocopter Assembly

Scale = 1:1

DETAIL A

Rubber Bands
1 per blade

Dihedral Angle 10°

Hub should rotate freely around the rotary shaft

Rotary shaft
Quantity = 1
Cut from 0.03 in. nominal carbon fiber rod
Length = 15.6 in.

Length should ensure the shock cord mount is flush with blade tips when blades are folded.

Shock cord mount
Glue to the rotary shaft and reinforce glue joint with nylon thread

Glue aluminum spacer to rotary shaft and reinforce with nylon thread

Back blade not shown for clarity
Rocket Attachment and Flying Instructions

Rocket Attachment Instructions:
1. Use an FAI-1 (5 deg taper) body tube for flying the gyrocopter.
2. Internally mount a Kevlar shock chord approximately 700 mm long to a fin using an external epoxy fin fillet.
3. Use an approximately 200 mm long elastic shock chord mounted to the gyrocopter shock cord mount.

Flying Instructions for 13 mm NAR Certified motors:
1. Insert motor.
2. Dispense 0.1 grams of black powder on top of the motor ejection cap.
3. Insert wadding in body tube.
4. Insert rubber bands on blade hooks (1 per hook, others are spares)
5. Fold blades and insert gyrocopter in the rocket making sure the shock cord is inserted into the body tube first and will not tangle around the blades as they eject.
6. Fly out of a tower.
Photographs of Sample Gyrocopter

Rotor Hub Bottom
Rotor Hub Top
Hub Attachment
Shock Cord Mount on Gyrocopter
Shock Cord Mount on Rocket
Shock Cord Mount on Fin Fillet of Rocket

Scale = NA
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Photographs of Sample Gyrocopter

Blades Taped on Mandrel Before Wrapping

Blades Wrapped on Mandrel

Finished Blades

Scale = NA
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