OFC SMS System Analysis Exercise

This is the result of: **Tire pressure increase due to mechanic suggestion. This suggestion comes as a result of flat tires and tube damage suspected multiple times.**

- Hazard Identification or
- **Policy or Procedure Change**

What risks concern the committee what level risk matrix was found? (reference committee matrix)

- 1 or 2 - Acceptable
- 3 - Caution
- **4 - Safety Officer Review Required**
- 5 - Unacceptable

Analysis Review: Please provide data found regarding the hazard or change and include sources.

- Initial assessment suggests that over inflating a tire could cause more problems and variables than the club currently has.
- More knowledge of when we began using 6 ply tires or how many hours the average tire lasts would help make a proper decision, but getting back to aircraft specifications would be most beneficial for our operation.
- Unable to find a document approving the current 6 ply tire being used.
- Both "Initial Assessment" and "Post-Research Analysis" are below…
- https://www.aviationconsumer.com/maintenance/aircraft-tire-burnout-goodyear-is-tops/
- https://www.aviationconsumer.com/maintenance/nitrogen-tires-unnecessary-for-small-aircraft/

Assessment: Provide a new risk matrix assessment after discussion of analysis with the identified hazard or change.

- 1 or 2 - Acceptable
- **3 - Caution**
- 4 - Safety Officer Review
- 5 - Unacceptable

Control: What recommendations to system manager shall be made? Not limited to, but including:

- Threat identification
  - Mechanic possibly using improper part for type certificate causing improper performance.
- Threat mitigation
  - MX Team should closely monitor part usage and request mechanics use only approved parts and specifications.
- Data supporting/opposing
  - Tire and pressure found on current archer fleet is in question of whether it's an approved tire per manufacturer approved ply type.
- Suggested changes to lower risk of requested change or hazard identified
  - Review all service bulletins and ensure all parts used on club fleet will be in compliance of type certificate to eliminate variables within types of usage.

Initial Assessment

OFC fleet tires have recently appeared to have experienced an increase in tire replacement. Two separate damage events have been cited: Skid flat spotting and complete loss of pressure. Closer observation of tire condition did reveal that club airplanes were routinely operating with under-inflated tires.

Correct inflation has been cited in all aircraft tire manufacturers guidance as essential to safe and prolonged tire life. The club initiated a pressure maintenance campaign that includes adding tire pressure gauges to the airplanes and placarding POH tire pressures near the wheels. Checking tire pressure during preflight was made the subject of a recent OFC Safety Zoom.

Since this change, two losses of tire pressure events have occurred. One happened off airport and the failed tube and tire was not retained for inspection. The second event occurred at KOXC during landing and resulted in a temporary runway closing and resulting FAA inquiry. This tire was inspected by Wright Aviation and determined to be damage to the inner tube as a result of pinching of the tube. This pinching was described as the result of possible tire rotation on wheel or compression during landing.

Inner tube damage is described in aviation tire literature as one consequence of under inflation. This can cause tire slippage resulting in wear (abrasion) or pinching (shearing) of the tube. Tire deflection (bending) due to under inflation may also increase past the design limit and result in high temperature damage to tire and tube. This damage can be cumulative and loss of inflation may not occur coincident with the under inflation event.

A suggestion was proffered by Wright that we increase tire pressure beyond that specified by our Piper Archer II POH. They suggested the resultant increase in bead pressure would reduce the chance of tire slippage. It would also reduce tire deflection during hard landings and reduce resultant pinching.

Increasing pressure beyond manufacturer specified number introduces other concerns. The first is that Piper chose this inflation based on their own calculations and this takes into consideration the design deflection of the tire side wall. Aircraft tires have a high sidewall deflection (about 34%). This allows proper footprint and tire operation for braking and cornering. If inflation changes, deflection changes and the consequence on braking and steering is changed by an unknown quantity.

Tire inflation is limited by the load rating of the tire. Tire load rating is nominally a function of Ply rating. Our airplanes are approved for 4 ply tires which have a nominal max allowed inflation of about 29psi. Normal maximum tire inflation based on 105% of published inflation is 27psi for our Archers. So to use the 30+ psi numbers suggested would require that lager ply values be required. Our planes currently have either Condor or Airhawk 6 ply tires mounted. These tires would be capable of the higher pressure. The use of specific 6 ply tires on our serial number aircraft would need to be confirmed and then mandated.

It remains to be seen whether specific authorization to operate at higher than specified tire pressures would require specific approval from the FAA in the form of an STC or field approval, or if Piper has

published any supportive documentation. Therefore, this operation includes legal as well as operational risks that are difficult to fully assess.

Wright Aviation offered an additional strategy that would further help evaluate the need for extraordinary action. Their suggestion was to paint an overlapping index mark between the tire and wheel. This index could be checked during preflight. Any misalignment of the mark between the wheel and tire would indicate slippage of the tire and require further investigation.

Operation at higher than specified tire pressures could have unintended consequences. The loss of footprint could increase skid events and resultant flat-spotting. Therefore reducing one problem and increasing our other tire problem. It may be that using a 6 ply tire instead of a 4 ply tire has also had an effect on foot print and tire life. This could increase flat spotting. If problems persist with skidding, we could consider a change to 4 ply tires or consider trying a different brand of tire. This would require some planning as mixing different tire ply or brand is not recommended.

Post - Research Analysis

Inflation of tires above POH value inflating tires above POH value is a significant change in operating procedure that warrants a risk analysis. Increasing pressure is suggested by Wright Aviation as a strategy to reduce flat tire events. The increase in inflation pressure would increase the tire bead pressure and reduce tire slippage on rim. This slippage causes pinching or stress on the inner tube and air loss. It was also suggested that higher pressure would reduce compression of the tire during hard landings, this in turn, would alleviate pinching and damage of the inner tube by the wheel rim.

The pressure suggested by Wright Aviation is substantially higher than that published in the POH. This is justified by their statement that the POH tire pressure chosen by Piper is, for marketing reasons, lower than required. This remains anecdotal; however, it is philosophically in line with advice given by many similar respectable shops. Their experience with many aircraft rolling onto their ramps is that most aircraft are operating with chronically underinflated tires. The reason is that pressure checks occur too infrequently.

Many aircraft tire manufacturers publish detailed aviation tire documents for selecting and maintaining tire health. The recurring advice is that tire pressure must be carefully maintained at + or – 1 psi of the pressure in the aircraft POH. They further state that some leakage of pressure is normal and therefore recommend that tire pressure be checked daily or before each flight. Aircraft tires have a large amount of deflection (34%). Deflection is designed into the tire and is maintained by a specific inflation relative to the weight carried by the tire. This exact deflection is necessary for proper function of the tire. Too much deflection and sidewall flexing increases, leading to overheating and damage, too little and tire shape and footprint are altered, reducing contact with the surface.

To conduct a thorough risk analysis, threats and their corresponding risks need to be identified. The first threat is the higher tire pressure. This could result in a risk to the structure of the tire itself. The Piper Archer II operating handbook specifies a 6.00 x 6 4-ply tire. Ply refers to nylon pile layers in the tire but has evolved with new stronger materials to represent a load rating. The load rating is measured in pounds and results in a maximum rated tire pressure. Most 4 ply tires have a max pressure of 29 psi. This would mean these tires are already very close to their maximum rated pressure when operating at the POH value of 27psi (26+1). To operate at higher pressures would require going to a higher ply which

is not approved for our planes. Operating at a higher than prescribed ply can have its own risks and therefore be a compounding threat. Greater than necessary tire ply may affect the deflection and flex of the tire and thus cause changes in footprint and surface contact.

It should be noted that Wright has been placing 6 ply tires on our Archers. 6 ply tires are prescribed for the Skylane, and this may be simply a well-intentioned method of reducing the variety of tires in inventory. It may be that using 6 ply tires with stiffer sidewalls and tread means the beads does not seat as well on the wheels. Thus, raising pressure might alleviate this. However by compounding our deviations from procedure it becomes difficult to objectively evaluate the results of our actions. Plus we may be moving into a gray legal area which obligates an STC to operate.

The tire that failed on the runway in Oxford was reported to have been about a year in service. This means it operated before the recent campaign to label tire pressures, put pressure gauges on aircraft and to make correct tire pressure a preflight item. It is likely be that during this period it operated for some period at low pressure which may have left residual damage to the tire and tube.

At this point, before attempting the extraordinary actions of operating unapproved tires at unapproved pressures, we should fully explore our ordinary options and allow sufficient time to evaluate them. Specifically; continue the preflight pressure check program and reinforce its importance with our members. Replace the 6 ply tires on the Archers with the correct specified 4 ply tires. (The present 6 ply can be kept for future use on the Skylane). Mark tires and wheels with paint so tire slippage is detectable. Make this check a preflight item. Get a good quality air gauge from an aircraft supplier to verify validity of aircraft gauges. Re-inflate tire pressure 24 hours after tire change to offset air trapped between tube and tire that has seeped out.

Other considerations: Evaluate other tire brands and models. There may be a tire better suited for our operation. Aviation Consumer has a comparison (attached). Use nitrogen as fill agent. This would require purchase of tank and filler apparatus (available through Aircraft Spruce). It would also require specific training for members. This has questionable practicality. Reinforce correct landing and rollout procedures with membership to reduce skid flat spotting.