

SOLOY DUAL PAC[®]

POWERPLANT



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POWERPLANT CHARACTERISTICS

- A powerplant concept consisting of two independently operating engines driving a single propeller through a patented Soloy combining gearbox which incorporates redundant:
 - Freewheeling Units
 - Drivetrains
 - Governing Systems
 - Lubricating Systems
 - Overspeed Protection
 - Thrust Bearings

- A longitudinal firewall with integrated ballistic shield provides each engine with both fire, and uncontained projectile protection/isolation.

- The powerplant is designed to provide uninterrupted power to the propeller shaft in the event of an engine and/or drive side failure: a “**Continue To Run**” concept.

SYSTEM REDUNDANCY

GEARBOX:

- Three Isolated Sections
 - Left and right power inputs and propeller shaft compartment

TWIN ENGINES:

- Independent Lubrication Systems

TWIN FREEWHEELING CLUTCHES:

- On the propeller shaft.

PROPELLER SHAFT:

- Proven PT-6 Design
- Independent Lubrication Systems
 - Includes one hour (backup) lubrication in the event of primary system failure
- Propeller Bearings
 - Designed to rigid specifications
 - Bearing redundancy
 - Dedicated oil flow to bearings

POWER & SPEED CONTROL COMPONENTS:

- Propeller Governor
- Overspeed Governor
- N_1 Governor

TWIN-ENGINE, SINGLE-PROPELLER

CENTERLINE THRUST

With one engine inoperative:

- No asymmetrical thrust
- No increased drag

AERODYNAMIC EFFICIENCY vs. CONVENTIONAL TWINS

- No wing nacelles
- No turbulent propeller flow over wings
- 18% reduction in coefficient of drag
- 9% cruise speed increase @ same weight & power
- 20% OEI climb rate increase @ same weight & power

PROPELLER EFFICIENCY

- One large propeller vs. two smaller propellers
- Slower turning: quieter, more efficient
- Larger diameter: more efficient
- No sound pulses or propeller ice against fuselage
- No propeller synchrophasers needed

EVALUATION OF FAILURE MODES

	Conventional	DualPac
	<u>Twin</u>	<u>Twin</u>
Engine Failure, symmetry to thrust	Yes	No
Asymmetric reverse, symmetry to thrust	Yes	No
V _{MC} training, symmetry to thrust	Yes	No
Feather wrong propeller, symmetry to thrust	Yes	No
Failure to feather, symmetry to thrust	Yes	No
Propeller failure, symmetry to thrust	Yes	No
Single propeller failure, total thrust loss	No	Yes

POWERPLANT RELIABILITY

PT6 ENGINE

- Observed IFSD rate .01 per 1000 hours. (One IFSD per 100,000 hours)

HARTZELL PROPELLER

- Observed rate for any mode of propeller failure is .0004 per 1000 hours based on FAA service difficulty reports. (One failure per 2,500,000 hours)
- Predicted rate for any mode of propeller failure is .0005 per 1000 hours based on RADC study sponsored by USAF. (One failure per 2,000,000 hours)
- Observed failure rate for single Hartzell/PT-6 combination:

	<u>Fleet Hours</u>	<u>Propeller Failure Forced Descent</u>
Cessna C208	2,000,000	None
Beech T-34C	2,000,000	None
Pilatus PC-6,-7,-9,-12	<u>2,000,000</u>	<u>None</u>
	6,000,000	None

SOLOY DUAL PAC® GEARBOX

- Predicted rate for any type of failure causing total loss of thrust is .0000000114 per 1000 hours (1.14×10^{-8}) (One failure per one hundred million hours)

SOLOY DUAL PAC® POWERPLANT RELIABILITY

- In two million hours there exists the possibility of 40 PT-6 IFSDs and one propeller failure mode of any type.
- Asymmetrical thrust *accidents* occur at 5 times the rate of propeller failure of any type (one asymmetrical thrust accident per 400,000 hours).

POWERPLANT RELIABILITY SUMMARY

EACH

100,000 HOURS:	One PT-6 engine in-flight shut down
400,000 HOURS:	One asymmetrical thrust conventional twin-propeller accident
2,000,000 HOURS:	One propeller system failure of <u>any</u> type
20,000,000 HOURS:	Estimated frequency of catastrophic loss of thrust due to propeller failure

SAFETY ANALYSIS OF TWIN-ENGINE SINGLE-PROPELLER INSTALLATIONS

Richard L. Newman
 CREW SYSTEMS CONSULTANTS
 San Marcos, Texas
 30 March, 1993

Installation	Predicted Accidents per Year				
	Total	Percent Change	Catastrophic	Fatal	Minor
Conventional Twin-Propeller Twin-Engine	6.0	-	1.5	0.1	3.5
Soloy Single-Propeller Twin-Engine with Reverse	2.7	(55.0)	0.1	1.2	1.2
Soloy Single-Propeller Twin-Engine without Reverse	2.2	(63.3)	0.1	0.6	1.2
Conventional Single-Engine Single-Propeller	9.7	61.7	0.1	---	0.9

TABLE 13: ACCIDENT RATES USING SINGLE-ENGINE INFLIGHT SHUTDOWN RATES BASED ON A FLEET OF 800 AIRPLANES EACH FLYING 1,000 HOURS PER YEAR (percent change column added by Soloy). NOTE: Summed totals vary slightly due to rounding. (From Crew Systems Consultants' Report TR-93-03, page 18)

CATASTROPHIC = multiple fatalities. If there is only one occupant and the aircraft was destroyed, a fatal accident is classified as a catastrophic accident.

FATAL = an accident with a single fatality.

SERIOUS = an accident involving serious injuries or the destruction of the aircraft.

MINOR = an accident involving minor injuries and substantial aircraft damage.

PRELIMINARY DUAL PAC SAFETY EVALUATION
Seattle Area Aircraft Certification Office (ANM 100S)
January, 1996

NTSB DATA BASE:
1983 TO 1994 (11years)
Accidents and major incidents
Twin propeller airplanes under 20,000 pounds
Propeller control failures included
Pilot errors included

RESULTS:	
SOLOY BETTER OUTCOME	40%
SOLOY SAME OUTCOME	48%
SOLOY WORSE OUTCOME	12%

NET 28% IMPROVEMENT WITH SOLOY'S TWIN-ENGINE, SINGLE-PROPELLER CONCEPT