Attachment 1

AIRCRAFT N306D Queen Air

Aircraft Instrumentation

	Parameter Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recording				
				Range	Accuracy	Time Constant	Precision	Resolution
	Air Temperature	Platinum resistance	Rosemount 102 e2AL	-50°C to +50°C	± 0.5°C	1.1 sec.	± 0.1°C	0.1°C
*	Air Temperature	Tungsten resistance wire	Developed at NCAR	-100°C to +50°C	± 1.0°C	.0 1 sec	± 0.3°C	0.03°C
	Static press	Variable capacitance	Rosemount '830BC25	1100 to 300mb	± 1.0 mb	0.5 sec	± 0.5mb	0.40 mb
	Dynamic press	Variable cap.	Rosemount 831EC25	0 to 70 mb	0.5 mb	0.5 sec	+ 0.5mb	0.035 mb
	Dew point Temperature	Frost point hygrometer	Cambridge Systems 137-C3	0 to +50°C -30 to 0°C -30° to -50°	±0.3°c ±0.6°C ±1.1°C	3.0°C/sec	± 0.5°C	0.1°C
	Geometric Altitude	Radio Altimeter	Sperry AA-220	0-762 meters	±1.5m,0-30m ±8.0m,0-150m	.16 sec +53m,150-762m		0.762 meters
	Air temperature	Reverse flow-Pt resistance wire	Developed at NCAR	-70° to +50°C	± 0.5°C	5 sec	± 0.1°C	0.06°C
*	Angles of attack and sideslip	Constrained force sensing vanes(located on boom)	Developed at NCAR	± 8 degrees	0.5 degrees	.03 sec	±0.05 degrees	0.02 degrees
*	Angle of attack	Free aligning vane (located on boom)	Developed at NCAR	± 10 degrees	"	"	±0.08degrees	0.03 degrees
*	Airspeed - dynamic press.	Strain gauge (Pitot tube located on boom)	Tavis	0-70mb	1% full scale	0.02 sec	0.7mb	0.05mb

* Indicates parameters electronically filtered at f_c = 4 Hz with low pass four-pole Butterworth filters.

Computed Parameters:

1.
2.
3.
4.

Description of Recording System: ARIS III - In house developed hybri system capable of recording analog and digital inputs serially on magneti tape. The sampling frequency for each instrument varies according to instrument specifications.

Attachment 1

AIRCRAFT N306D Queen Air

Aircraft Instrumentation

Parameter Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recording				
			Range	Accuracy	Time Constant	Precision	Resolution
Aircraft Attitude angles	Gyro stabilized inertial platform with digital navigational computer	Litton LTN-51 Inertial Navigation System	$\pm 22.5^{o}$ pitch $\pm 90^{o}$ roll $\pm 180^{o}$ yaw	± 0.5 arc min	1/8 sec update		1 arc min
Horizontal accelerations & velocities	↓	↓	0 to 1000m/sec		0.1sec. update		0.05 m/sec
Vertical acceleration			$\pm 3000 m/sec^2$		1/8sec update		$0.0025 m/sec^2$
Heading (true)			0 to 360^{o}		1 sec update		5 arc min.
Position, latitude and longitude			0-90^{o} N-S	± 0.5 arc min	1sec. update		5 arc min.

Computed Parameters:

1.
2.
3.
4.

Description of Recording System: _____

Attachment 2

AIRCRAFT N307D Sabreliner

Aircraft Instrumentation

Parameter Measured	Instrument Type	Manufacturer and Model No.	Combined Performance of Transducer, Signal Conditioning and Recording				
			Range	Accuracy	Time Constant	Precision	Resolution
Total Temp.	Pt Res. Wire	Rosemount 102E2AL	-70 to +30 C	±0.5 C	1.0 sec.	0.2 C	0.1 C
Static Press.	Var. C. Trans.	Rosemount 830BM4	1050 to 150mb	±0.5 mbar	0.5 sec.*	1.0 mbar	0.5 mbar
Boom Static Pressure	Var. C. Trans.	Rosemount 1301A4BX	1050 to 150mb	±0.5 mbar	0.5 sec.*	1.0 mbar	0.5 mbar
Dynamic Press. (Airspeed)	Var. C. Trans.	Rosemount 831L6	0 to 275 mb 0 to 230 m/s	±0.6 mbar	0.5 sec.*	0.6 mbar 0.5 m/s	0.3 mbar 0.23 m/s
Boom Angle of Attack	Strain Gauge Diff. Press.	Statham PM184TC (modified)	±15°	±1°	0.5 sec.*	0.2°	0.016° nom.
Boom Angle of Sideslip	Strain Gauge Diff. Press.	Statham PM184TC (modified)	±15°	±1°	0.5 sec.*	0.2°	0.016° nom.
Mag. Heading	C-11 Compass	Sperry Gyroscope	0 to 360°	±0.75°	1.5 sec.		0.1°
Dew-Frost Point temp.	Thermoelectric Hygrometer	E G & G 137	-30 to + 30	±1.0°C	2°C/sec		0.1°C
Horizontal Velocity	Computer and Accelerometer	Litton LTN-51 Inertial Navigation System	0 to 1000m/s	following are Manufacturer's Specifications (0.1 sec. update)			0.05 m/s
Vertical Acceleration	Accelerometer		±3000 m/ss		(1/8 sec. update)		0.0025m/s
True Heading	Computer		0 to 360°		(0.2 sec. update)	.02°/hr drift	5 arc min.
Attitude Angles: Pitch, Roll, Yaw	8-speed Resolver		±90° P ±90° R 0 to 360° Y	±0.5 arc min	(1/8 sec. update)	.02°/hr drift 50% CEP	0.4 arc min.
Latitude and Longitude	Computer		0 to 90°N&S 0 to 180°E&W		(1 sec. update)	2.6km/hr drift 50% CEP	5 arc sec.
Precip. Echoes	X-band radar	RCA AVQ-55	60nmi/110km;	7.4° beam diameter; 15kw peak output power; can be photogr.			
Photography	16mm camera	Giannini III-B	0.125 to 16 frames/second;	can view outside left and/or right windows			

Computed Parameters:

1. Horizontal Winds
2. True Airspeed
3. Static Air Temperature
4. Vertical Gust Velocity
5. Geographical Location
6. Pressure Altitude (ICAN)
7. Potential Temperature

Description of Recording System: In-house developed hybrid system (ARIS capable of recording analog and digital inputs serially on mag. tape Specifications above pertain to a tape speed of 3.75ips (4 hr rec. time The sampling frequency determines cutoff frequency of parameters with asterisks (*) in the time constant column.

Attachment 3

AIRCRAFT N595KR (NCAR Electra)

Aircraft Instrumentation

Parameter Measured	Instrument Type	Manufacturer & Model No.	Combined Performance of Transducer, Signal Conditioning, and Recording				
			Range	Accuracy	Time Constant#	Precision	Resolution
Total Air Temperature	Platinum Resistance	Rosemount Engr. Co 102E2AL	-60 to +40°C	± 0.2°C	0.16 sec	± 0.2°C	0.02°C
Total Air Temperature	Reverse-Flow Housing	NCAR Development	-60 to +50°C	± 0.5°C	8 to 10 sec	± 0.2°C	0.03°C
Total Air Temperature	1 meter Tungsten wire	NCAR Development	-60 to +50°C	± 1.0°C	0.016 sec	± 0.3°C	0.03°C
Moisture Content	Thermoelectric Hygrometer	EG&G 137-C3-S3	-50 to +50°C	±0.5°C > 0°C ±1.0°C < 0°C	0.32 sec	± 0.1°C	0.01°C
Moisture Content	Lyman-Alpha Hygrometer	NCAR Development	0 to 40g/kg	----	0.05 sec	----	0.01 g/kg
Pressure Altitude	Variable Capacitance	Rosemount Engr. Co 1301-A	300 to 1035 mb	± 1 mb	0.16 sec	± 0.5 mb	0.09 mb
Indicated Airspeed	Variable Capacitance	Rosemount Engr. Co 1301-B	0 to 150 m/s	± 0.2 m/s	0.16 sec	± 0.2 m/s	0.03 m/s
Indicated Airspeed	Variable Reluctance	Tavis P-1	0 to 125 m/s	±0.2 m/s	0.016 sec	----	0.03 m/s
Geometric Altitude	Radio Altimeter	Sperry Rand AA-220	0 to 762 m	±1.5m, 0-30m ±8m, 30-150m ±53m, 150-762m	0.16 sec	----	0.19 m
** Cloud Liquid Water Content	Hot-wire Flowmeter	Johnson-Williams LWH	0 to 6 g/m^3	----	1.5 sec	----	0.001 g/m^3

Revised 1/9/75

Computed Parameters:

1. Ambient temperature
2. True airspeed
3. Horizontal winds
4. Vertical gust velocities
5. Geographical position
6. Potential temperature
7. Vertical acceleration

Time Constants are generally determined by the data system.

AIRCRAFT N595KR (NCAR Electra)

Aircraft Instrumentation

Parameter Measured	Instrument Type	Manufacturer & Model No.	Combined Performance of Transducer, Signal Conditioning, and Recording				
			Range	Accuracy	Time Constant#	Precision	Resolution
** Cloud Drop Spectrum	Laser Spectrometer	Particle Measuring Systems	23 to 322 μm	----	1 sec	----	23 μm
** Hydrometeor Spectrum	Laser Spectrometer	Particle Measuring Systems	300 to 4500 μm	----	1 sec	----	300 μm
Radiometric Sfc Temp.	Bolometric Radiometer	Barnes Engr. Co. PRT-5	-20 to +75°C	±0.5°C	0.16 sec	----	0.01°C
Infrared Radiation	Bolometric Radiometer	Barnes Engr. Co. PRT-6 w/NCAR mods	-135 to +65°C	±1.3°C	Determined by sampling program	----	0.02°C
Infrared Radiation	Pyrgeometer 4 to 45 μ	Eppley PIR	0 to 2.5 * Ly/min	----	1 sec	----	0.006 Ly/mi
Visible Radiation	Pyranometer 285 to 2800mμ	Eppley 2-WG7	0 to 2.5 * Ly/min	----	1 sec	----	0.006 Ly/mi
Visible Radiation	Pyranometer 285 to 530mμ	Eppley 2-OG1	0 to 2.5 * Ly/min	----	1 sec	----	0.006 Ly/mi
Visible Radiation	Pyranometer 285 to 700 mμ	Eppley 2-RG8	0 to 2.5 * Ly/min	----	1 sec	----	0.006 Ly/mi
Angle of Attack	Fixed Vane (strain gage)	NCAR Development	±10°	±0.5°	0.016 sec	----	0.005°
Angle of Sideslip	Fixed Vane (strain gage)	NCAR Development	±10°	±0.5°	0.016 sec	----	0.005°
Angle of Attack	Rotating Vane (LVDT)	NCAR Development	±10°	±0.5°	0.016 sec	----	0.002°

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*Range and resolution variable.

** NOT RECORDED

AIRCRAFT N595KR (NCAR Electra)

Aircraft Instrumentation

Parameter Measured	Instrument Type	Manufacturer & Model No.	Combined Performance of Transducer, Signal Conditioning, and Recording				
			Range	Accuracy	Time Constant	Precision	Resolution
Angle of Sideslip	Rotating Vane	NCAR Development	$\pm 10^{\circ}$	$\pm 0.5^{\circ}$	0.016 sec	----	0.005°
Aircraft Pitch Angle	Inertial Nav Resolver	Litton APD 917055	$\pm 45^{\circ}$	$\pm 0.008^{\circ}$	0.016 sec	----	0.005°
Aircraft Roll Angle	Inertial Nav Resolver	Litton APD 917055	$\pm 45^{\circ}$	$\pm 0.008^{\circ}$	0.016 sec	----	0.005°
Inertial Platform Hdg	Inertial Nav Resolver	Litton APD 917055	$\pm 45^{\circ}$	$\pm 0.05^{\circ}$	0.016 sec	----	0.005°
Aircraft Ground Speed	Inertial Nav System	Litton LTN-51	0 to 400m/s	$\pm$ 1 m/s*	0.032 sec	----	0.04 m/s
Aircraft Vertical Vel	Inertial Nav System	Litton LTN-51	$\pm$ 50 m/s	± 0.10 m/s	0.016 sec	----	0.012 m/s
Aircraft True Heading	Inertial Nav System	Litton LTN-51	0 to 360°	$\pm 0.05^{\circ}$	0.064 sec	----	0.001°
Inertial Wander Angle	Inertial Nav System	Litton LTN-51	0 to 360°	$\pm 0.05^{\circ}$	0.064 sec	----	0.001°
Index of Refraction	Microwave Refractometer	National Bureau of Standards	0 to 300N	----	0.016 sec	----	0.037N
Aircraft Latitude	Inertial Nav System	Litton LTN-51	$\pm 90^{\circ}$	$\pm 0.066^{\circ}$	1 sec	----	0.001°
Aircraft Longitude	Inertial Nav System	Litton LTN-51	$\pm 180^{\circ}$	$\pm 0.066^{\circ}$	1 sec	----	0.001°

Revised 1/9/75

*The indicated values are means for flights of four hour durations, longer flights will result in degraded accuracy without external update.