KEY WORDS: Aviation Safety; Aviation Security; National Security; Terrorism; Homeland Security; Flight Recorder; Remote Pilot; 9/11; Communication; ADS-B; Safelander

THE 21ST CENTURY AVIATION SECURITY AND SAFETY SYSTEM

I.E.E.E. LOS ANGELES CHAPTER

COMMUNICATION, SIGNAL PROCESSING AND VEHICULAR TECHNOLOGY

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Some Reference URL's

- **Safelander**
  - **http://safelander.com/**
- **The Remote Aircraft Flight Recorder and Advisory Telemetry System, RAFT** (Patented)**,**
  And It's Ability to Reduce fatal Air Accidents By 78%
  While Enhancing Air Space Capacity, Operational Efficiency and Aircraft Security
  - **http://www.ntsb.gov/events/symp_rec/proceedings/authors/levine.pdft**
- **New Statistics Show Need To Improve Air Safety Record**
  - **http://www.findarticles.com/p/articles/mi_m0UBT/is_47_13/ai_57788793**
- **US PATENT AND TRADEMARK OFFICE (PATENT NUMBER SEARCH):**
  - **http://patft.uspto.gov/netahtml/PTO/srchnum.htm**
    - **"Safelander" 7,099,752 Lenell & Levine August 29, 2006**
    - **"Remote, aircraft, global, paperless maintenance system" 5,974,349 Levine October 26, 1999**
    - **"Remote aircraft flight recorder and advisory system" 5,890,079 Levine March 30, 1999**
- **AIEE/IEEE/SAE Digital Avionics Conference (DASC) Nov. 1998 "The Remote Flight Recorder …"**
  - **htpp://www.ieeexplore.ieee.org/iel4/5955/15955/00739808.pdf?arnumber=739808**

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FIGURE 1
SAFELANDER'S AVIONICS SYSTEM

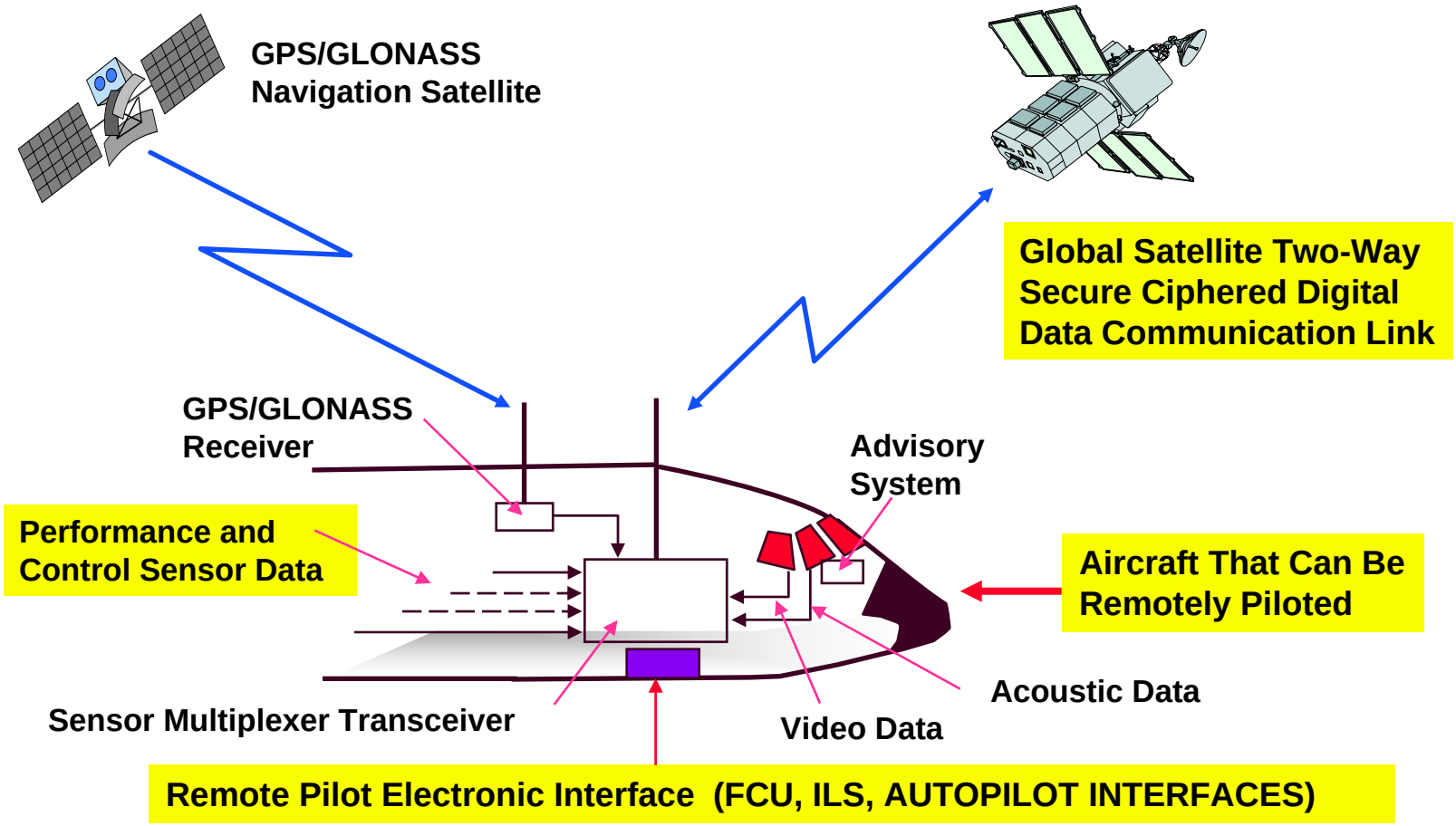


FIGURE 2
SAFELANDER COMMUNICATION SYSTEM OVERVIEW

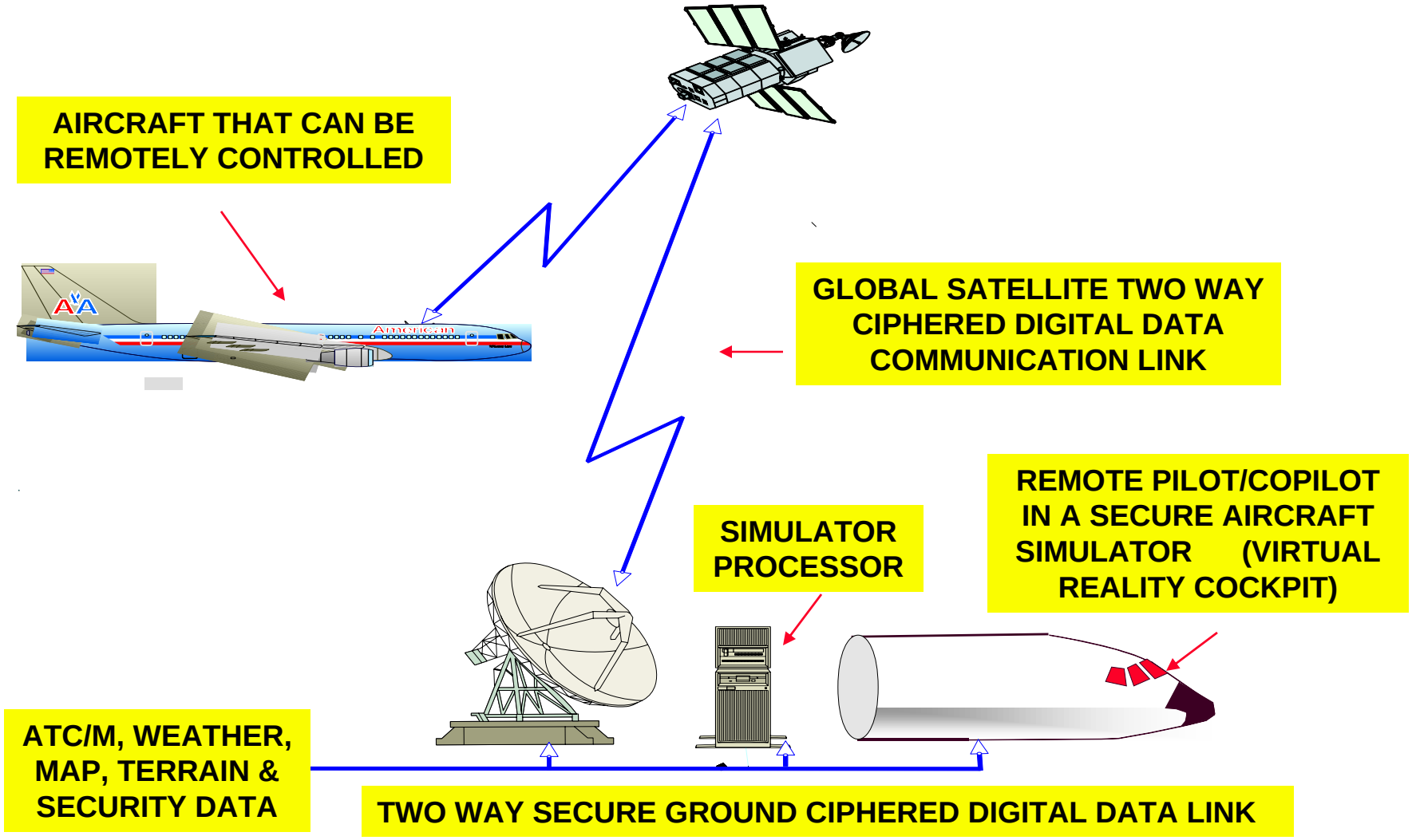


FIGURE 3 LEO SATELLITE TWO-WAY CIPHERED DIGITAL DATA & VOICE GLOBAL COMMUNICATION LINK

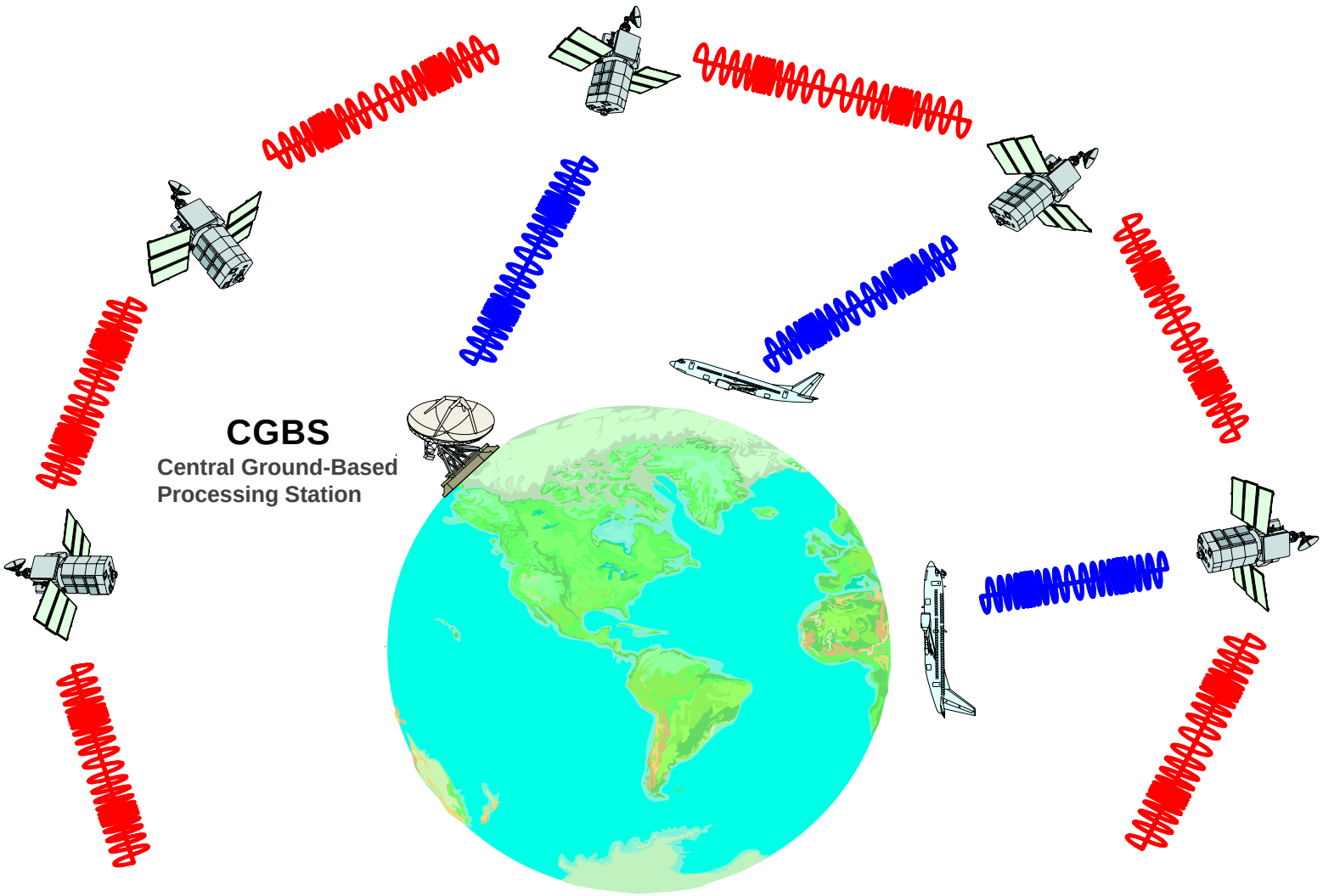


TABLE 1

SAFELANDER BASIC DATA STORAGE AND RATES
25 MEGA-BAUD AND STORAGE 100 GIGA-BYTE/DAY

COM. SATELLITE CAPABILITY/ YEAR	2008	2006	2004	2000
NUMBER FLTS/DAY (GROWTH 2.5%/YR.)	38,896	37,944	35,280	33,600
AVERAGE FLIGHT TIME IN MINUTES	95	95	95	95
DFDR DATA RATE IN WORDS/SEC/AIRCRAFT	128	128	128	64
DFDR DATA WORD LENGTH IN BITS	12	12	12	12
DFDR DATA RATE (BITS/SEC/AIRCRAFT)	1,536	1,536	1,536	768
TOTAL DATA RATE FOR ALL OPERATIONAL AIRCRAFT (NOTE: LESS THAN 8000 AIRCRAFT IN OPERATION – SKY OR TARMACK) IN MEGA-BAUD	12.288	12.288	12.288	12.288
USING 2X (SHANNON) MULTIPLICATION YIELDS THE TOTAL DATA RATE IN MEGA-BAUD	25	25	25	25
DAILY STORAGE FOR ALL AIRCRAFT EASILY FITS ON A SINGLE PC DISC. IN GIGA-BYTES	100	100	100	100

FIGURE 4

CENTRAL GROUND-BASED PROCESSING STATION (CGBS)

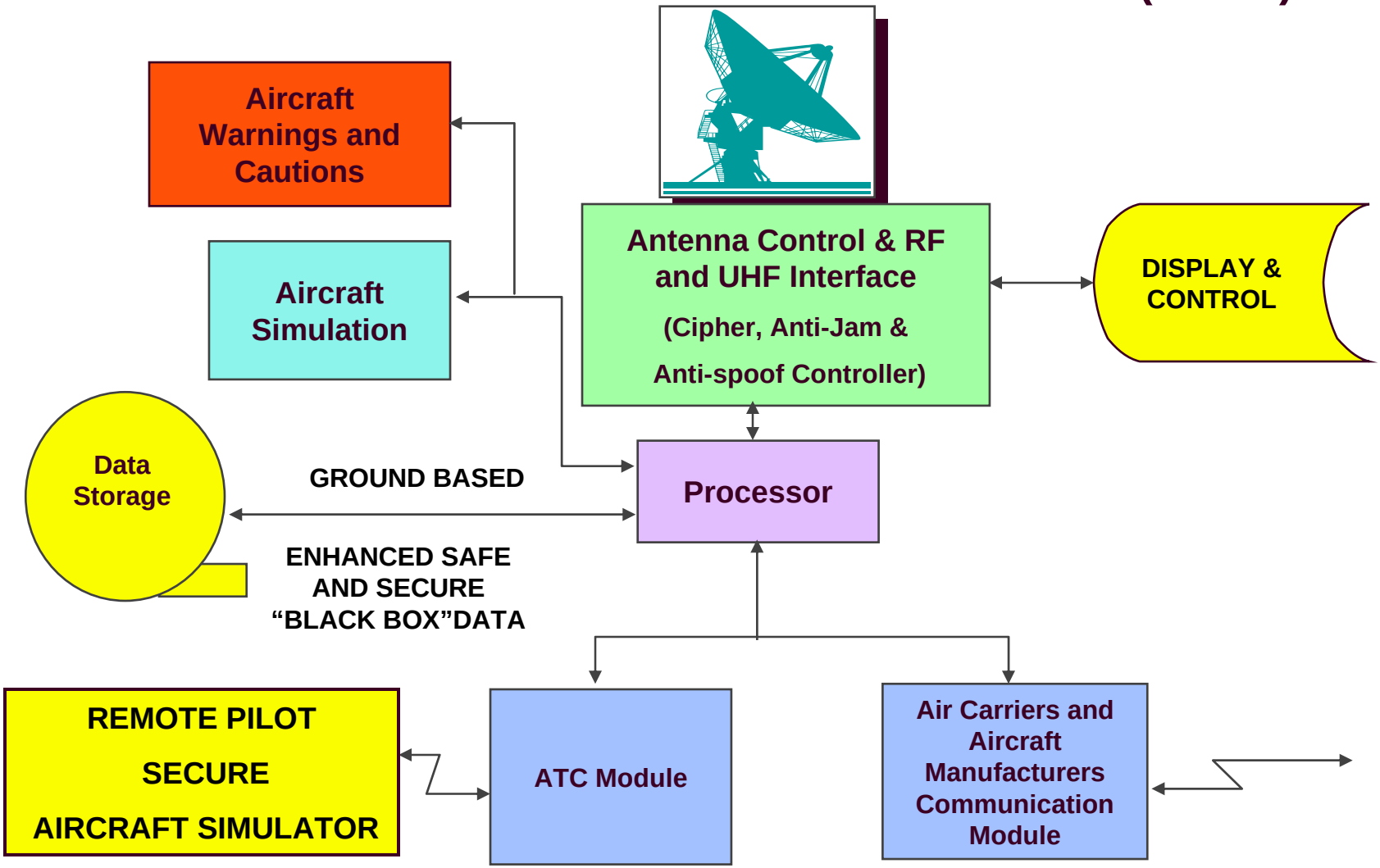


FIGURE 5

GROUND-BASED DISTRIBUTION SYSTEM

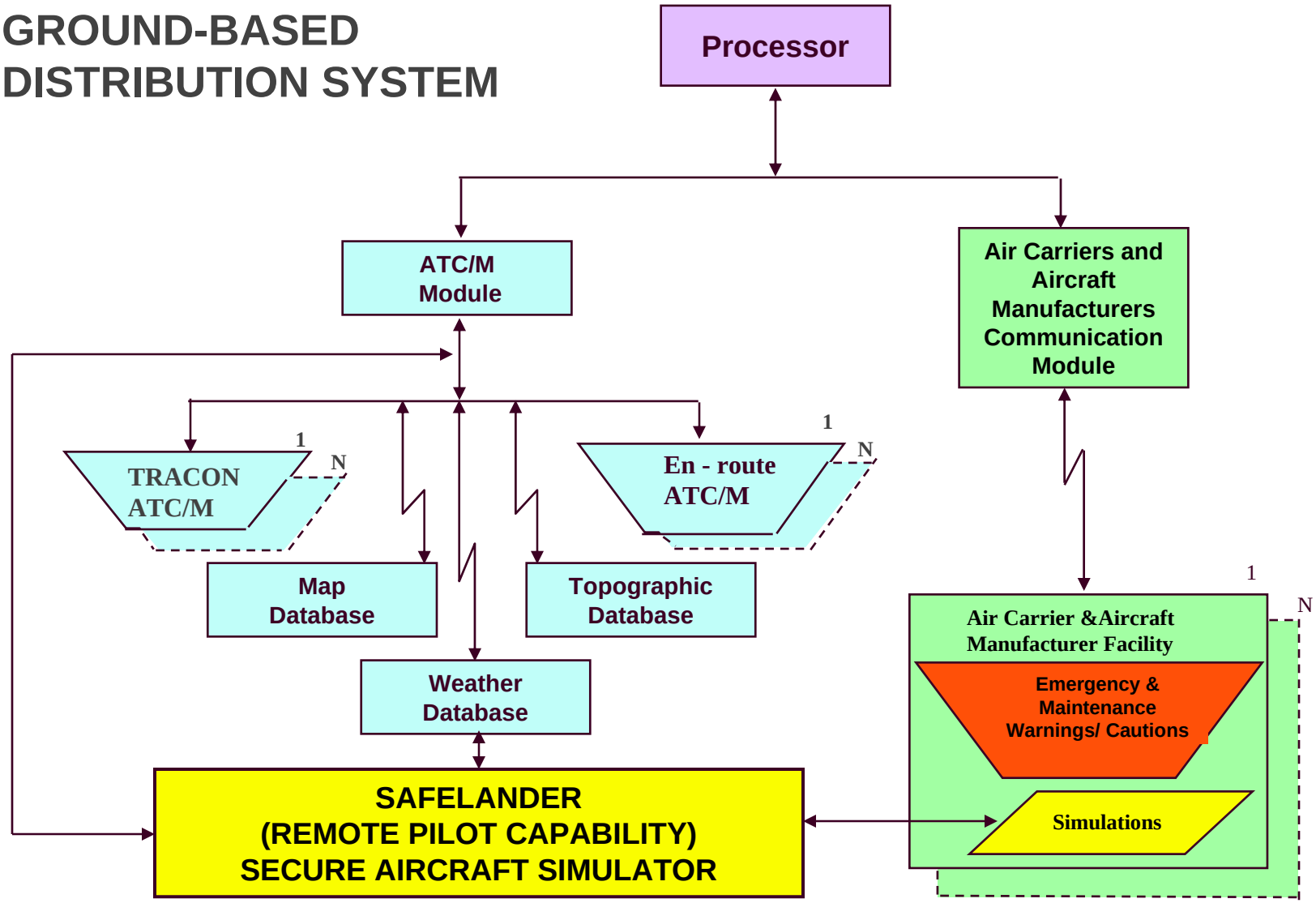
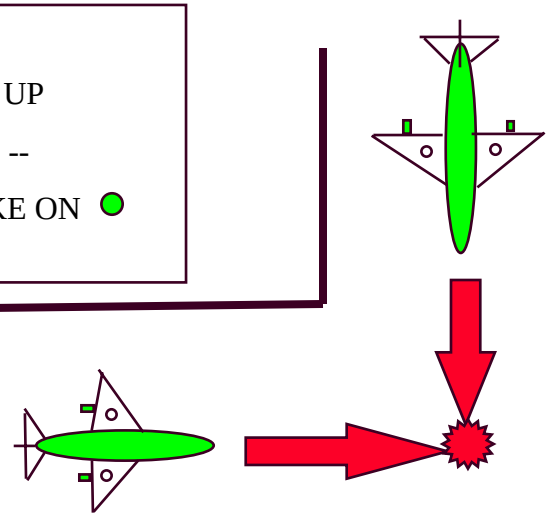


FIGURE 6 TENERIFE (583 FATALITIES) ET AL.

SAFELANDER PROVIDES AUTOMATED COLLISION AVOIDANCE ALERTS ATC/M & CAS ENHANCED CAPABILITY DISPLAY

TRANSLATOR

	DOWN	UP
LANDING GEAR	○	--
LANDING GEAR DOWN- BRAKE ON	●	



Note: The 583 fatality Tenerife crash was head on. This pictorial is a generic representation and shows aircraft orthogonal on the runway.

COLOR CODE TRANSLATOR

AIRCRAFT	GREEN	RED	BLUE
FUSELAGE	PLANE MOVING	STOPPED	-------
ENGINE	HIGH THRUST	OFF	LOW
BRAKE	ON	-------	-------

PROJECTION

COLLISION TRAJECTORY

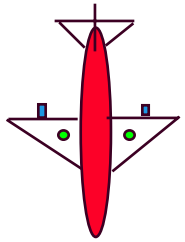
ESTIMATED COLLISION POINT

FIGURE 7 TENERIFE, ET AL., NO MORE

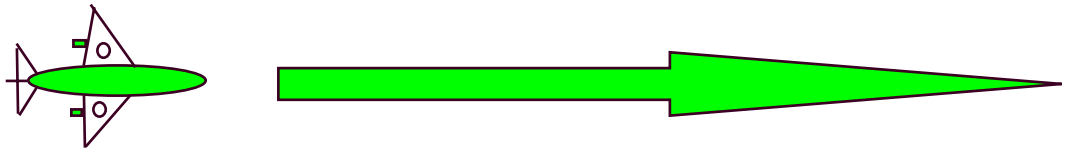
SAFELANDER PROVIDES A SAFE TRAJECTORY DISPLAY
ATC/M & CAS ENHANCED CAPABILITY

TRANSLATOR

	DOWN	UP
LANDING GEAR	○	--
LANDING GEAR DOWN- BRAKE ON	●	



Note: The 583 fatality Tenerife crash was head on. This pictorial is a generic representation and shows aircraft orthogonal on the runway.



COLOR CODE TRANSLATOR

AIRCRAFT	GREEN	RED	BLUE
FUSELAGE	PLANE MOVING	STOPPED	-------
ENGINE	HIGH THRUST	OFF	LOW
BRAKE	ON	-------	-------

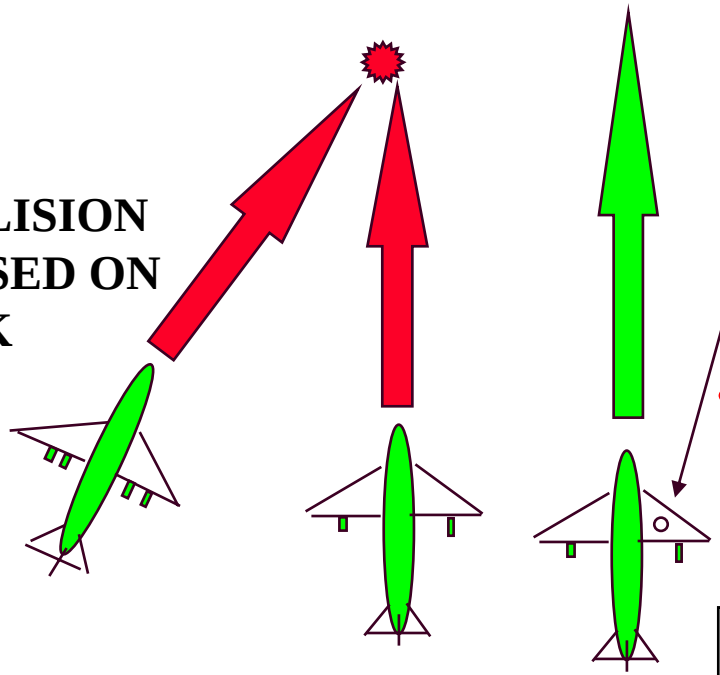
PROJECTION
SAFE TRAJECTORY

FIGURE 8 SAFELANDER CAS DISPLAY

PROJECTED COLLISION TRAJECTORY BASED ON AIRCRAFT TRACK

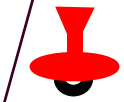
VECTORS

- **VELOCITIES (Vn,Ve, Vh)**
- **PRESENT POSITIONS**
- **PROJECTED POSITIONS**



NOTE: ONE LANDING GEAR IS DOWN

FLASHING PROBLEM ICONS



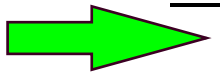
LANDING GEAR

15 MINUTES OF FUEL REMAINING

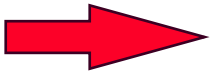
TRANSLATOR

	DOWN	UP
LANDING GEAR	○	--

PROJECTION TRAJECTORIES



SAFE



COLLISION

ESTIMATED COLLISION POINT

FIGURE 9 SAFELANDER PROVIDES AN AIRCRAFT DATA SUPERHIGHWAY (SIMILAR TO THE INTERNET) THAT RESPECTS AN AIR CARRIER'S PRIVILEGED DATA

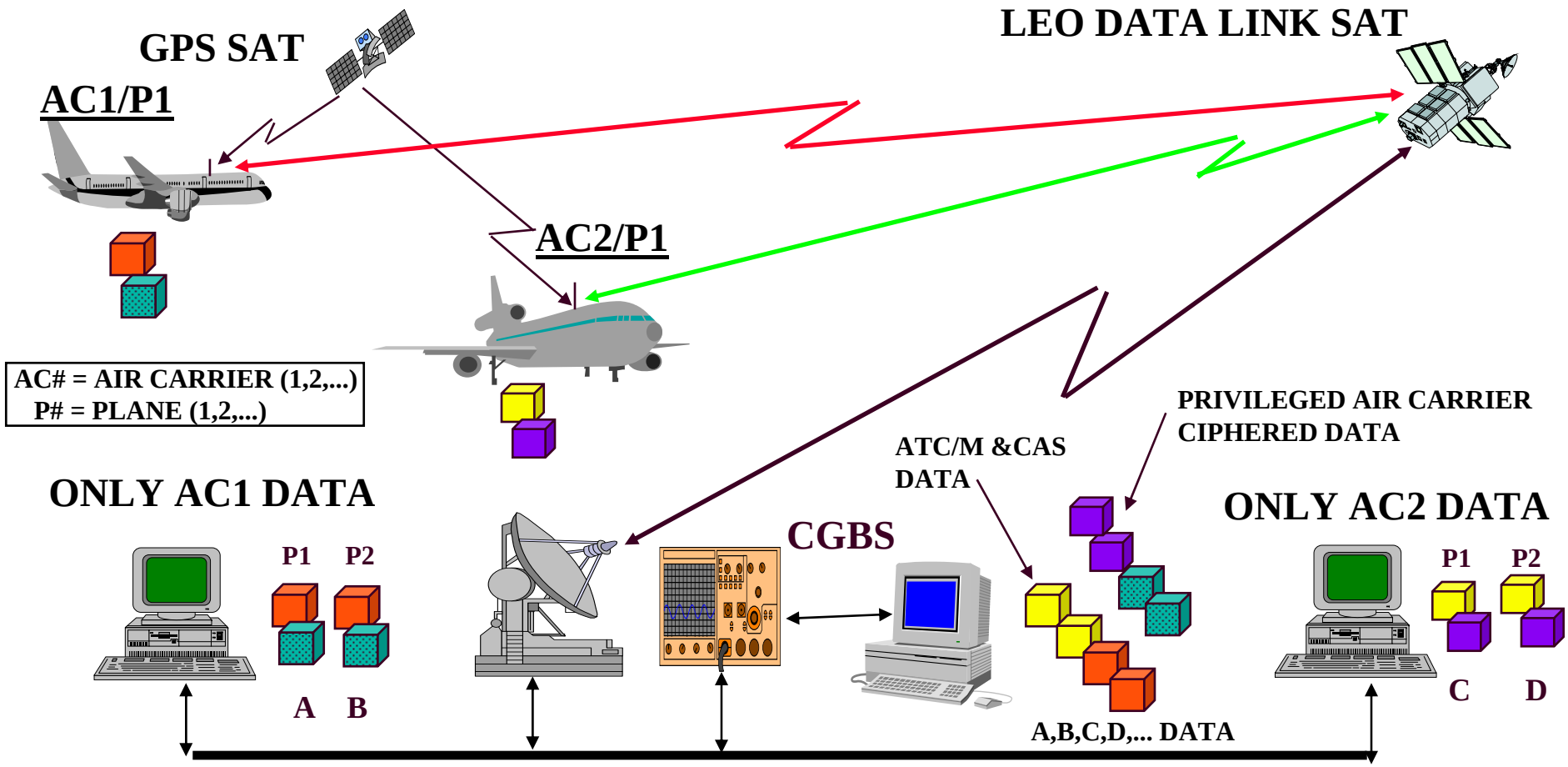


FIGURE 10

CHRONOLOGY OF SATELLITE PER FLIGHT COMMUNICATION COSTS

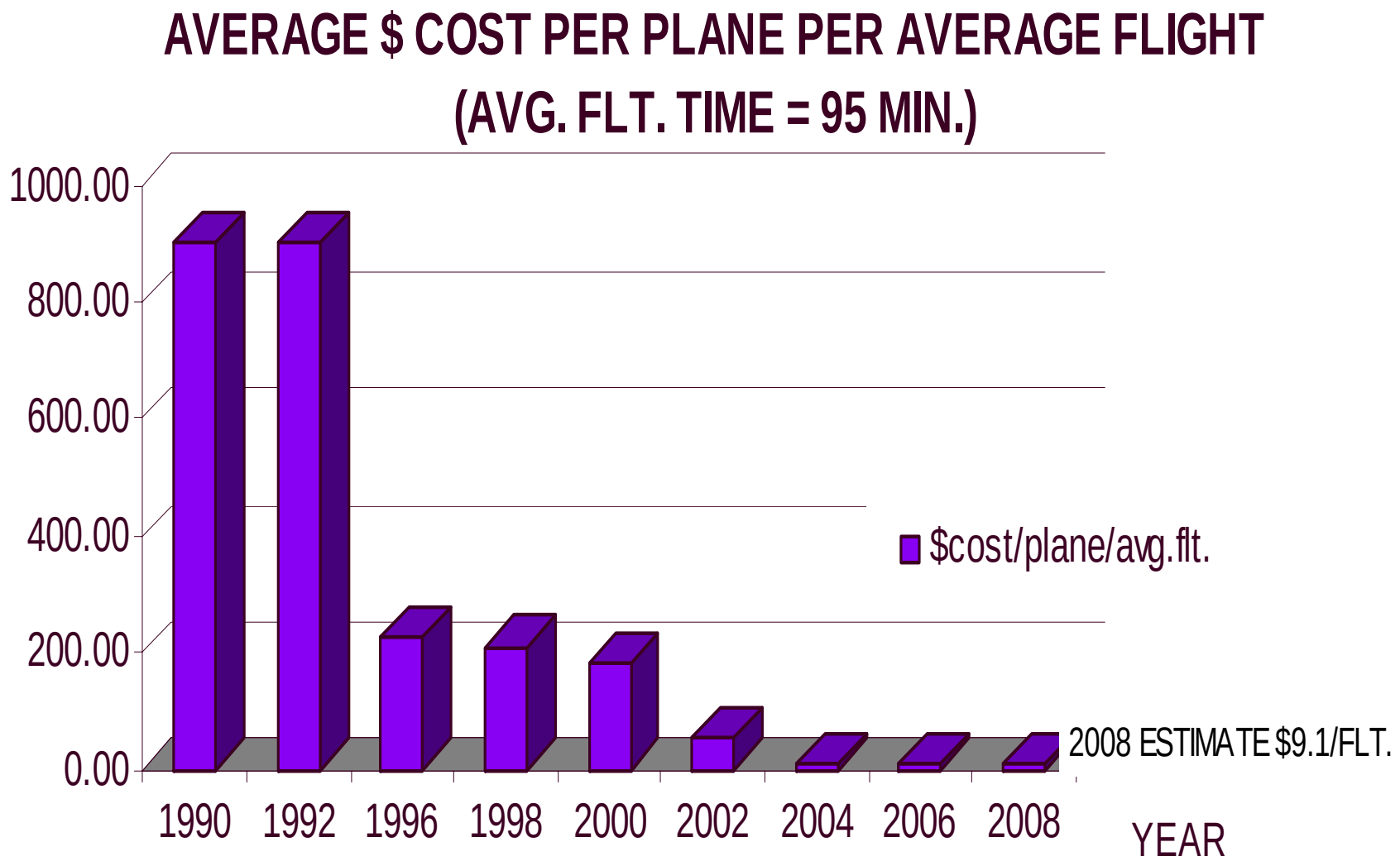


TABLE 2 WORLDWIDE AIR CARRIER FATALITIES AND FATAL ACCIDENTS

THE YEARS 1987 THROUGH 1996 (NOTE: DOESN'T INCLUDE 3000 DEATHS IN 9/11/2001)

					RAFT	RAFT	RAFT
	Total	Total	US Operators	US Operators	Total	Total	US Operators
FATAL ACCIDENT TYPE/QTY	Fatalities	%Fatalities	Fatalities	%Fatalities	Fatalities	%Fatalities	Fatalities
Controlled Flight Into Terrain (CFIT)	2396	32.01%	312	19.68%	479	17.04%	62
- CFIT Only On Approach	957	12.79%		0.00%	191	6.81%	0
Loss of Control In Flight	2228	29.77%	482	30.41%	1114	39.62%	96
In Flight Fire	760	10.15%	340	21.45%	152	5.41%	68
Sabatage	607	8.11%	254	16.03%	546	19.43%	229
Mid-air Collision	506	6.76%	0	0.00%	101	3.60%	0
Hijack	306	4.09%	38	2.40%	275	9.79%	34
Ice and/or Snow	162	2.16%	57	3.60%	32	1.15%	11
Landing	128	1.71%	3	0.19%	26	0.91%	1
Windshear	119	1.59%	37	2.33%	36	1.27%	11
Fuel Exhaustion	113	1.51%	0	0.00%	23	0.80%	0
Other Unknown	111	1.48%	17	1.07%	22	0.79%	3
Runway Incursion	45	0.60%	45	2.84%	5	0.16%	5
Rejected Take Off (RTO)	3	0.04%	0	0.00%	1	0.02%	0
TOTAL FATALITIES	7484	100%	1585	100%	2812	100%	521
% REDUCTION IN FATALITIES					62%		67%
					RAFT	RAFT	RAFT
	Fatal	% Fatal	US Fatal	US % Fatal	Fatal	% Fatal	US Fatal
FATAL ACCIDENT TYPE/QTY	Accidents	Accidents	Accidents	Accidents	Accidents	Accidents	Accidents
Controlled Flight Into Terrain (CFIT)	36	26.47%	4	11.76%	7	15.32%	1
Loss of Control In Flight	38	27.94%	11	32.35%	19	40.43%	2
In Flight Fire	4	2.94%	2	5.88%	1	1.70%	0
Sabatage	5	3.68%	1	2.94%	5	9.57%	1
Mid-air Collision	2	1.47%	0	0.00%	0	0.00%	0
Hijack	8	5.88%	1	2.94%	7	15.32%	1
Ice and/or Snow	5	3.68%	3	8.82%	1	2.13%	1
Landing	9	6.62%	1	2.94%	2	3.83%	0
Windshear	3	2.21%	1	2.94%	1	1.91%	1
Fuel Exhaustion	7	5.15%	0	0.00%	1	2.98%	0
Other Unknown	14	10.29%	6	17.65%	3	5.96%	1
Runway Incursion	4	2.94%	4	11.76%	0	0.00%	0
Rejected Take Off (RTO)	1	0.74%	0	0.00%	0	0.00%	0
TOTAL FATALITIES	136	100%	34	100%	47	100%	8
% REDUCTION FATAL ACCIDENTS					65%		78%

WITHOUT SAFELANDER IT WILL RECUR

WITH SAFELANDER WE HAVE A COST EFFECTIVE SOLUTION TO OUR SAFETY AND SECURITY

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21ST CENTURY
AVIATION SECURITY AND SAFETY SYSTEM

- On August 29, 2006, the United States Patent Office issued US Patent Number 7,099,752 named SAFELANDER, which supplements the onboard pilot of an aircraft with a ground-based remote-pilot/copilot safety system. Such a system could have prevented attacks such as 9/11.
- When the 9/11 planes deviated from their approved flight plans, the remote-pilot/copilot (in a secure, high-fidelity, virtual-reality aircraft simulator) using ciphered telemetry could have taken control of all of the deviant aircraft and landed them safely at airports in sparsely populated areas.
- The highly-qualified remote-pilot can safely fly the aircraft in congested air space, via ciphered radio telemetry to the aircraft and air traffic controllers.
- The advanced telemetry permits the remote-pilot/copilot to control an aircraft just as if he/she were the onboard pilot.
- SAFELANDER eliminates many problems associated with the recovery and utilization of onboard flight data recorders/black-boxes since all communications and flight data are safely stored, in real-time on the ground, in the computer's memory for post flight analysis.

21ST CENTURY
AVIATION SECURITY AND SAFETY SYSTEM

- The SAFELANDER remote-pilot/copilot has many advantages over the current day onboard-only pilot approach, since the remote-pilot/copilot is not subject to loss of oxygen, extreme G forces, temperature, smoke, passenger disturbances and terrorists.
- The ground-based cockpit virtual-reality simulator minimizes problems associated with pilot disorientation, poor visibility, weather, runway selection and ground incursions, which have resulted in numerous fatal accidents.
- From a safety standpoint, the remote-pilot/copilot can also communicate directly with flight operations, emergency and security personnel, as well as with the aircraft manufacturer's design/engineering experts on how best to handle an aircraft operation problem thereby preventing the loss of life.
- Additionally, a single remote-pilot could concurrently and safely fly a plurality of airplanes using well known aircraft spacing/separation.

IN CONCLUSION SAFELANDER:

1. **increases homeland security by safely, quickly and remotely diverting aircraft away from major edifices and energy facilities (in many instances fighter aircraft do not have the response time necessary to prevent a future variant of 9/11, etc.);**
2. **increases aircraft security by reducing the incentives to hijack an aircraft;**
3. **increases aircraft safety because of fewer crashes by providing expert systems which share in real-time a comprehensive set of flight and ground data, crash avoidance strategies and can remotely control/land an aircraft should the flight crew become disabled (e.g.: golfer-Payne Stewart/1999, Helios Flight 522/2005, Swissair Flight 111/1999, crash etc);**
4. **saves lives and reduces injuries;**
5. **enables free-flight great circle routes and thereby decreases flying time and saves fuel;**
6. **prevents aircraft from flying into restricted airspace by diverting aircraft to non-restricted areas;**

IN CONCLUSION SAFELANDER:

7. reduces personnel costs by eliminating the onboard copilot in aircraft (e.g., cargo flights);
8. reduces aircraft avionics by removing the electronics required for an onboard copilot;
9. reduces the aircraft weight by removing the onboard copilot's seat and controls;
10. reduces aircraft fuel cost per pound of payload by eliminating items unrelated to payload;
11. reduces the maintenance costs for aircraft avionics and mechanical systems by having less of them;
12. reduces aircraft purchase costs by eliminating items unrelated to payload;
13. reduces insurance costs and liability claims, and
14. increases aircraft payload by utilizing the space and weight gained from the reduction of aircraft avionics, copilot seat & controls, and the onboard copilot.

ALWAYS SMILE WHILE YOU'RE FLYING SINCE EVERYTHING IS UNDER CONTROL

CONCLUDING REMARKS

- **QUESTIONS**
- **OPEN DISCUSSION OF THE ISSUES & PRESENTATION**

Back-up Material 9/11/2001

- **Notice that the departure and crash times would have permitted a single remote pilot in a ground-based simulator to take real-time control of each aircraft and sequentially land them at sparsely populated landing sites:**

- **On September 11, 2001 the following occurred:**

AIRCRAFT	CAR.	FLT	DEPARTURE	CRASH	SITE	FATALITIES
BOEING 767	AAL	11	7:59 AM	8:46 AM	WTC	92
BOEING 767	UAL	175	7:58 AM	9:03 AM	WTC	65
BOEING 757	AAL	77	8:10 AM	9:43 AM	PENTAGON	64
BOEING 757	UAL	93	8:44 AM	10:10 AM	PA.	44

- **A total of 265 died aboard aircraft and about 2700 died on the ground.**

- **The cost of the disaster was estimated at over 10 billion dollars which is more than five times the estimated 2 billion dollars required to make SAFELANDER operational.**