



U.S. Joint Helicopter Safety Analysis Team

**The Compendium Report:
The U.S. JHSAT Baseline of Helicopter Accident Analysis**

Volume II

(CY2000, CY2001, CY2006)

**To
The International Helicopter Safety Team**

July 2011

Summary

The U.S.-JHSAT analyzed 523 U.S. registered helicopter accidents that occurred in CY2000, CY2001 and CY2006. This report establishes a baseline for future work by the U.S. Joint Helicopter Implementation Measurement Data Analysis Team (JHIMDAT). This report contains the combined JHSAT analysis of ALL accidents and introduces recommendations which may have prevented these particular accidents and if implemented potentially avoid similar accidents in the future.

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Appendix A – U.S. JHSAT Methodology

The JHSAT modified the original CAST process to better account for helicopter accident data, which is considerably less detailed than commercial accident data. In helicopter accidents, there is often lack of recorded data from the helicopters and lack of in-depth government investigation of the accidents. The report addresses these data deficits and makes recommendations to address them. IHST representatives have met with the U.S. National Transportation Safety Board on multiple occasions to suggest methodologies for improving helicopter accident investigations.

In its analysis of a second year of U.S. helicopter accidents (CY2001) the JHSAT used best practices previously developed, with modifications suggested by IHST partners who had initiated helicopter accident analysis in Europe. The JHSAT process now uses helicopter-specific Problem Categories and Statements, and helicopter-specific Intervention Categories and Statements. Starting with its analyses of CY2001 accidents, the JHSAT used “occurrence” categories (e.g.: Loss of Control, System Component Failure, autorotations, etc.) instead of “mission” categories to group similar accidents. By assigning occurrence categories to each accident, the team categorized accidents according to where the accident happened, what the pilot or crew were doing, the result, and the environmental conditions under which the accident occurred. This analysis methodology is intended to allow a better understanding of the data, and promote effective safety implementation strategies by the U.S. JHSAT and others. CY2000 data was later amended to include these categories.

The dataset of accidents of the U.S.-registered helicopter fleet for the CY2000, CY2001 and CY2006 were analyzed using National Transportation Safety Board (NTSB) accident report docket. Accidents involving kit-built helicopters were not included in this study. The JHSAT analyzed 197 CY2000 accidents (which included 2 foreign registered), 174 CY2001 accidents and 152 CY2006 accidents. As of this report, the U.S. JHSAT has analyzed 523 rotorcraft accidents.

Data issues were reported in SPS, Interventions and Occurrence findings for all years. The JHSAT noted that most of the reports lacked digital or investigative data necessary to fully determine the accident circumstances. The result is a less than ideal identification of specific mitigations that would prevent similar accidents in the future. While incomplete Data reporting does not directly cause accidents, the lack of a definitive determination of accident causal factors may result in lost opportunities for accident prevention, with the possibility of similar accidents occurring in the future as a result of this missing information. The CY2006 Report has a more complete discussion of this issue. This Compendium presents the Data issues percentages in SPS, IRs and Occurrences tables but does not further analyze them.

Appendix B – Occurrence Category by Mission

	Aerial Application	Aerial Observation	Air Tour / Sightseeing	Business	Commercial	Electronic News Gathering	Emergency Medical Services	External Load	Firefighting	Instructional/Training	Law Enforcement	Logging	Offshore	Personal/Private	Utilities Patrol / Construction	Grand Total
ADRM-F			1											1		2
ADRM-H							1							2		3
ADRM-M	1		1	2										2		6
ADRM-P													1			1
AMAN		1	2	2	2	1	1	1		6			1	4		21
ARC	3	1	3	1	4	2				16	5			5		40
AUTO-E	11	4	13	5	3	1	8	5	5	13	8	6	8	22	2	114
AUTO-P	1		1		1		2			39	8			5		57
CFIT		2	1		4		3			1			3	2		16
DATA	35	14	18	20	30	5	30	10	14	80	27	10	16	68	8	385
DITCH				1									7	4		12
EXTL	1				2			7	4			9			2	25
FIRE-NI	1						2		1					1		5
FIRE-Post	3		3		2	1	2		2	3	1		1	8	1	27
FUEL-Carb	2	1		1										2		6
FUEL-Cont	1			1									2	1		5
FUEL-Ex	6	1	2				1	1					1	6		18
FUEL-St	1		1				2			1	1	1		3	1	11
ICE			2		1		1	1	1					1		7
LOC-DR	2	1	1		2	1	1	2	2	10	1		1	5	2	31
LOC-EP	4		1		4	2	2	1	1	1	2	1	1	3		23
LOC-GR							2				1			2		5
LOC-Int			2	1	1		1			12						17
LOC-LTE	1	1		2	2	2		1		3	3		2	5	1	23
LOC-OL	2	2	2	1	3	2	2		1	2	2		1	6	1	27
LOC-PM	3	1	5	3	7		4	1		30	7			17	1	79
LOC-SP	2													1		3
LOC-TD	2	1							1							4
LOC-UNK	1		1	1	1		2	1	3	2			1	2		15
LZ-P					1		1			1						3
LZ-U	1	2			7	1	4	1	1	7	2	1		9		36
RAMP	1			1	1		2						1	1		7
SCF-E	3	1	10	1	3		4	2	4	7	3	4	3	8		53
SCF-H	10	4	9	7	1	3	4		4	6	6	6	5	8	2	75

	Aerial Application	Aerial Observation	Air Tour / Sightseeing	Business	Commercial	Electronic News Gathering	Emergency Medical Services	External Load	Firefighting	Instructional/Training	Law Enforcement	Logging	Offshore	Personal/Private	Utilities Patrol / Construction	Grand Total
SCF-M	1				1			2				1				5
SCF-U	3							1		1	1		1	6		13
STRIKE-HTOL			1		3		4			2	1	1	1	8		21
STRIKE-LALT/M	18	2			3	1			2	1				2		29
STRIKE-Obj	3	3		2	1	1	6	1	3	1	3	1	1	10	2	38
UNK-Oth	1				1						1			1		4
UNK-Reg	2	1	5	1			2	1	2	2	2	1	3	8		30
VIS-FG	2				1		1		1		1					6
VIS-FL		1	1		4						1					7
VIS-GW		1														1
VIS-IIMC	1	2	1	1	4	2	5			1	3		2	4		26
VIS-N	2	1			1	1	6			1	4		2	4		22
VIS-SG	1								1							2
VIS-W/B					3		3		1		1					8
WSTRW-TS	1				1											2
Grand Total	133	48	87	54	105	26	109	39	54	249	95	42	65	247	23	1376

Appendix C – Top 20 – Standard Problem Statement (SPS) Level 3

Rank	SPS Level 1	SPS Level 3	All	% All
1	Pilot Judgment & Actions	Autorotation – Forced	99	18.9%
2	Pilot Judgment & Actions	Disregarded cues that should have led to termination of current course of action or maneuver	92	17.6%
3	Pilot Judgment & Actions	Pilot control/handling deficiencies	80	15.3%
4	Maintenance	Failure to perform proper maintenance procedure	55	10.5%
5	Pilot Judgment & Actions	Autorotation – Practice	54	10.3%
6	Pilot Situational Awareness	Aircraft position and hazards	51	9.8%
7	Pilot Judgment & Actions	Inappropriate Energy/power management	51	9.8%
8	Pilot Judgment & Actions	Pilot’s flight profile unsafe – Altitude	47	9.0%
9	Pilot Judgment & Actions	Pilot decision making	45	8.6%
10	Ground Duties	Inadequate consideration of weather/wind	44	8.4%
11	Ground Duties	Performance of Aircraft Preflight procedures inadequate	43	8.2%
12	Pilot Judgment & Actions	Inadequate and untimely CFI action to correct student action	42	8.0%
13	Part/System Failure	Engine Component Failure	40	7.6%
14	Pilot Judgment & Actions	Selection of inappropriate landing site	40	7.6%
15	Safety Management	Management policies/oversight inadequate	36	6.9%
16	Pilot Judgment & Actions	Willful disregard for rules and SOPs	32	6.1%
17	Pilot Judgment & Actions	Improper recognition and response to dynamic rollover	28	5.4%
18	Post-Crash Survival	Post-Crash Fire	28	5.4%
19	Pilot Judgment & Actions	Failed to follow procedures	28	5.4%
20	Pilot Judgment & Actions	Diverted Attention	28	5.4%

Appendix D – Top 20 Intervention Recommendation (IR) Level 3

Rank	IR Level 1	IR Level 3	All	% All
1	Training/Instructional	Autorotation Training Program	68	13.0%
2	Maintenance	Follow ICA procedures with confirmation of compliance	62	11.9%
3	Training/Instructional	Simulator Training - Advanced Maneuvers	57	10.9%
4	Safety Management	Personal Risk Management Program (IMSAFE)	53	10.1%
5	Training/Instructional	Training emphasis for maintaining awareness of cues critical to safe flight	47	9.0%
6	Maintenance	Better Mx QA oversight to ensure adherence to the ICA/Manual	43	8.2%
7	Safety Management	Mission Specific Risk Management Program	41	7.8%
8	Training/Instructional	Enhanced Aircraft Performance & Limitations Training	37	7.1%
9	Training/Instructional	Emergency Procedures Training	36	6.9%
10	Training/Instructional	CFI judgment and decision making training to follow student more closely	36	6.9%
11	Systems and Equipment	Install proximity detection system	35	6.7%
12	Training/Instructional	In-flight Power/Energy Management Training	34	6.5%
13	Safety Management	Establish/Improve Company Risk Management Program	34	6.5%
14	Data/Information	Install data recording devices	33	6.3%
15	Safety Management	Use Operational Risk Management Program (Preflight)	32	6.1%
16	Safety Management	Use Operational Risk Management Program (In-flight)	30	5.7%
17	Training/Instructional	Simulator Training - Basic Maneuvers	28	5.4%
18	Training/Instructional	Risk assessment/management training	28	5.4%
19	Training/Instructional	Dynamic Rollover Training	28	5.4%
20	Regulatory	Recommend enforcement action - certificate suspension/revocation	28	5.4%

Appendix E – Intervention Recommendations Summary

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level 1)	Accident Count (No Dups)	Accident %
	Occurrence Total	27	46	62	320	63	526	16	67	39	133	23	755	93	34	430	294	56	231	2	3217	2571	1880		
D0000	Data/Information																						427	427	81.6%
D1000	Investigation																						215	215	41.1%
D1010	Improve quality and depth of NTSB investigation and reporting						187									2					189			189	36.1%
D1020	Provide feedback to the NTSB through Academy for the need for root cause analysis and more thorough documentation						2														2			2	0.4%
D1030	Require assessment of student training adequacy when student pilots involved in accidents						5														5			5	1.0%
D1040	Require std log book format and identification						1														1			1	0.2%
D1050	Require further investigation of flight critical parts failures						9					1				3					13			13	2.5%
D1060	Maintain a tight chain of custody on event evidence												1								1			1	0.2%
D1070	Congress to provide adequate field accident investigation resources						3														3			3	0.6%
D1099	Investigation - Other						2									1					3			3	0.6%
D2000	Recorder																						309	309	59.1%
D2010	Install cockpit recording devices			1			278						1				1	1			282			278	53.2%
D2020	Install data recording devices						31									2					33			33	6.3%
D2030	Install platform video recording devices						3														3			3	0.6%
D2040	Real time performance monitoring via satellite						1									1					2			2	0.4%
D2099	Recorder - Other																								0.0%
D3000	Disseminate safety info																						28	28	5.4%
D3010	Establish means to disseminate safety critical info to pilots, i.e., web site					1									1						2			2	0.4%
D3020	Increase awareness of common accident causes										3		9		1	1	3				17			17	3.3%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
D3030	Increase awareness of common risks associated with GSE via "traveling" workshops											1									1			1	0.2%
D3040	Update Rotorcraft Flying Handbook												1								1			1	0.2%
D3050	Develop stand alone risk assessment /management handbook for Part 91 community Similar to rotorcraft flying handbook, include decision making												3				1		2		6			5	1.0%
D3060	National Ag A/C Association (NAAA) develop Best Practices																1				1			1	0.2%
D3099	Disseminate safety info - Other				1																1			1	0.2%
E0000	Systems and Equipment																						225	225	43.0%
E1000	Cockpit Indication/Warning																						55	55	10.5%
E1001	Add external load meter												1								1			1	0.2%
E1002	Requirement for recorded load cell															1					1			1	0.2%
E1003	Automated cyclic load measuring equipment								1												1			1	0.2%
E1004	Automate carb anti-ice function, early warning alert function			1							6		1								8			8	1.5%
E1005	Ground equipment/Tie Down still attached Warning or break away capability	1											4								5			4	0.8%
E1006	Install door/cowl positive latch warning indication															2					2			2	0.4%
E1007	Install low rotor warning				1								1								2			2	0.4%
E1008	Low airspeed indicator/warning												6								6			6	1.1%
E1009	LTE indication system												3								3			3	0.6%
E1010	Fuel System improvements										11					1					12			12	2.3%
E1011	Hover drift indicator								1					1			2				4			4	0.8%
E1012	Modify cockpit design - add switch guard												1								1			1	0.2%
E1013	Modify cockpit design - change annunciation system												1								1			1	0.2%
E1014	Provide power avail vs power required indicator												11			1					12			12	2.3%
E1015	Recommend functional attitude indicator for night flight																		1		1			1	0.2%
E1099	Cockpit Indication/Warning - Other																	1			1			1	0.2%
E2000	Situational Awareness Enhancers																						91	91	17.4%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
E2010	Install EVS/SVS/NVG				1	3							1				2		14		21			19	3.6%
E2020	Install HTAWS equipment					2													3		5			5	1.0%
E2030	Train and equip with HTAWS, radar alt, EVS, SVS																		4		4			4	0.8%
E2040	Install radar altimeter					1			1				1				1		4		8			8	1.5%
E2050	Install proximity detection system		1						2				1	1		1	27		2		35			35	6.7%
E2060	TR strike protection													1		1	4				6			6	1.1%
E2070	Install rearward camera/video		1										1				4				6			6	1.1%
E2080	Short-term auto-hover recovery system												1						3		4			4	0.8%
E2090	Wire detection system for low alt ops					1											13				14			14	2.7%
E2099	Situational Awareness Enhancers - Other				1	1			1	1											4			4	0.8%
E3000	Post Incident Survivability																						67	67	12.8%
E3010	Install / use shoulder harnesses for all occupants				1											1	1				3			3	0.6%
E3020	Install WSPS		1			1								1			14				17			17	3.3%
E3030	Install engine auto relight kit				1						1	2				1					5			5	1.0%
E3040	Crash resistant fuel systems									22			1								23			23	4.4%
E3050	Improve helicopter specific ELT practices/standards			1		1				1						2	2		1		8			8	1.5%
E3060	Use EPIRB or personal location device	1				3															5			5	1.0%
E3099	Post Incident Survivability - Other		1	1		2			3				2				2				11			11	2.1%
E4000	PAH corrective action																						34	34	6.5%
E4010	Design approval holder implement corrective action and mitigate field risk			1	1						4		1			23					30			28	5.4%
E4020	Improved OEM manufacturing quality assurance															3					3			3	0.6%
E4030	Modify RFM - add warning to emergency procedure										1		2			1					4			4	0.8%
E4040	Recall affected components once hazard/failure is identified															1					1			1	0.2%
E4099	PAH corrective action - Other										3					2					5			5	1.0%
I0000	Infrastructure																						51	51	9.8%
I1000	Communications																						14	14	2.7%
I1010	Establish radio frequency compatibility standards													1							1			1	0.2%
I1020	Use of direct ground to AC communication					1							2	2	3		2				10			10	1.9%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level 2)	Count (Level 1)	Accident Count (No Dups)	Accident %	
I1030	FAA installation of ADS-B in GOM to facilitate IFR operations in adverse Wx and at night																		1		1			1	0.2%	
I1099	Communications - Other												1				1					2			2	0.4%
I2000	Ground support																						18		18	3.4%
I2010	LZ training for ground/LZ personnel												2	3	1					1		7			7	1.3%
I2020	Improved first responder training						1							1								2			2	0.4%
I2030	Operator mark/paint intended touchdown point on platform; and/or provide marshaller to guide platform landings	1												1	1							3			3	0.6%
I2040	Scheduled Mx check on windsock and fix on first failure noticed	1																				1			1	0.2%
I2099	Ground support - Other	3				1							1									5			5	1.0%
I3000	Pilot history																						13		13	2.5%
I3010	Develop industry standards for data collection and sharing of pilot history for hiring/screening										2		3							2		10			10	1.9%
I3020	Expand the Pilot Records Improvement Act to include rotorcraft pilots												2									3			3	0.6%
I3030	Aviation Medical Examiner cross check all available medical records before issuing Medical Certificate						1						1									2			2	0.4%
I3099	Post Incident Survivability - Other																									0.0%
I4000	Wx info																						10		10	1.9%
I4010	Better pilot availability/access to Wx information													1						2	1	4			4	0.8%
I4020	Implement local Wx PIREP system for intra/inter company flights					1														3		4			3	0.6%
I4030	Prevention of improper modification of Wx/nav aids	1																				1			1	0.2%
I4099	Wx Info - Other												1							1		2			2	0.4%
M0000	Maintenance																							125	125	23.9%
M1000	QA																						70		70	13.4%
M1010	Better Mx QA oversight to ensure adherence to the ICA/Manual												1			44		2				47			43	8.2%
M1020	Training for Mx supervisor															1						1			1	0.2%
M1030	Improve preflight and/or Mx inspections										4						12					16			16	3.1%
M1040	Mx Ops foreign debris/object safety review										1						1					2			2	0.4%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level 2)	Count (Level 1)	Accident Count (No Dups)	Accident %
M1045	Follow procedures in Mx/installation manual								1	1						3					5			5	1.0%
M1050	Procedures to prevent release of Aircraft in unairworthy status									1	1		1			6					9			9	1.7%
M1060	Require maintainer certification for TOT system Mx															1					1			1	0.2%
M1070	Use only FAA approved airworthy parts with known history										1					3					4			4	0.8%
M1099	QA - Other										3					4					7			7	1.3%
M2000	FCF																					8		8	1.5%
M2010	Establish company SOPs for conduct of Mx FCF				1						1		5			1					8			7	1.3%
M2020	Conduct Mx FCF risk assessment										1		2								3			2	0.4%
M2030	Clarify Mx FCF requirements for RTS															1					1			1	0.2%
M2099	FCF - Other																								0.0%
M3000	Instructions for Continued Airworthiness (ICA)																					77		77	14.7%
M3010	Follow ICA procedures with confirmation of compliance				1								2			83					86			62	11.9%
M3020	Evaluate adequacy of published ICA								1							11					12			12	2.3%
M3030	Automated component life monitoring															1					1			1	0.2%
M3040	Adopt civil aircraft Mx standards and applicable ICA's for mil surplus aircraft															7					7			6	1.1%
M3099	ICA - Other												1			1					2			2	0.4%
M4000	Recorder/Monitor																					41			0.0%
M4010	Engine Monitoring System (EMS) - impending failure warning															6					6			6	1.1%
M4020	Install part failure detection system (HUMS)															27					27			26	5.0%
M4030	Install performance trending equipment, HOMP		1										1			2			1		5			5	1.0%
M4040	Install HUMS/HOMP															8					8			6	1.1%
M4099	Recorder/Monitor - Other																								0.0%
M5000	Records Management																					19		19	3.6%
M5010	Establish Mx records systems, enhance retention requirements															11					11			10	1.9%
M5020	Audit of Mx record keeping and actions taken															5					5			5	1.0%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
M5030	Establish system to allow for reliable surplus parts tracking/identification															2		1			3			3	0.6%
M5099	Records Mgmt Other															2					2			2	0.4%
N0000	No Recommendation		3	5	71	5	1	10	19	10	4		27	2		28	15	1	3		204			174	33.3%
R0000	Regulatory																						103	103	19.7%
R1000	Oversight																						37	37	7.1%
R1010	SUPs investigation/enforcement actions										1					1					2			2	0.4%
R1020	Improve Government oversight of critical part Mx records															4		2			6			6	1.1%
R1030	Establish risk based process for mil surplus part oversight															2		2			4			4	0.8%
R1040	Improved Gov oversight Public Use												1					1			2			2	0.4%
R1050	Require applicants to show engineering knowledge and capability to meet design requirements as TC holders																	1			1			1	0.2%
R1060	Identify gov't agency responsible for mitigating field risk (recall)			1												1					2			2	0.4%
R1070	Improve design /system safety on field approval															1					1			1	0.2%
R1080	Increased Gov oversight of ops				1	2			2							2	1	6			14			14	2.7%
R1090	Increased Gov oversight of MX															3					3			3	0.6%
1099	Oversight - Other												2			1					3			3	0.6%
R2000	Regulations/Standard																					29		29	5.5%
R2001	Accelerate rulemaking and policy (HTAWS, SVS, EVS)																		2		2			1	0.2%
R2002	Adopt ICAO annex 14 helideck stds																	1			1			1	0.2%
R2003	Improve BLM/MMS stds and oversight of offshore landing platforms																								0.0%
R2004	Recommend Public Use comply with civil standards																		1		1			1	0.2%
R2005	Review FAA practice for approval of restricted to normal category aircraft																	1			1			1	0.2%
R2006	Review/update Reg requirements - IMC recovery training																		1		1			1	0.2%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level 1)	Accident Count (No Dups)	Accident %
R2007	Enhanced regulation or guidance for external load ops to minimize overloading (update AC133-1a ?)								1												1			1	0.2%
R2008	FAA order 8110.56 Restricted Cat Type Cert (2/27/06)												1			1		1			3			3	0.6%
R2009	Require public use aircraft to adopt Inter-agency Committee for Aviation Policy															1		1			2			2	0.4%
R2010	Review and update responsibility of POIs to identify and help operators mitigate hazards																		1		1			1	0.2%
R2011	Update AC 150/5345-27D, Spec for Windcones, to preclude improper modifications	1																			1			1	0.2%
R2012	Review and update part 135 ops HBATs/regulations that cover requirements for training																		1		1			1	0.2%
R2099	Regulations/Standards - Other								1		2	1	2		1	4		5	2		18			18	3.4%
R3000	Disciplinary action																					40		40	7.6%
R3010	Recommend enforcement action - certificate suspension/revocation	1	2						2		2	1	4			3	3	8	3		29			28	5.4%
R3020	FAA remedial action										2		1			1	3	1	1		9			9	1.7%
R3030	Disciplinary action targeted at the individual actually performing the Mx															2		1			3			3	0.6%
R3099	Disciplinary action - Other		1																		1			1	0.2%
R4000	Aircraft Registry																					2		2	0.4%
R4010	Easily accessed database of aircraft serial number, history, use, etc																		3		3			2	0.4%
R4099	Aircraft Registry - Other																								0.0%
S0000	Safety Management																						404	404	77.2%
S1000	Flight ops management																					92		92	17.6%
S1010	Formalized ops oversight program		1								3	1	2	1		2	3		5		18			17	3.3%
S1020	Establish/assert operational control/oversight by operator	1											4	1	1		3	1	3		14			14	2.7%
S1030	Improved supervisory and operational oversight		3	1	4	2					4		6	1			4		3		28			28	5.4%
S1040	Establish mission specific SOP and flight ops oversight program	1			3	3			1		1		9	1			4	1	1		25			25	4.8%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
S1050	Expand cold Wx operations procedures to include precautions to prevent engine inlet snow/ice accumulation											2									2			2	0.4%
S1060	Increased company briefing requirements regarding local area obstructions to include on-board charts																2				2			2	0.4%
S1070	Procedural intentional non-compliance (PINC) training			1							1	2	2			1	2	3	5		17			15	2.9%
S1099	Flight ops management - Other												1								1			1	0.2%
S2000	New Employees																					15		15	2.9%
S2010	Improve company ability to assess risks of low time pilot assignment	1											4				1				6			6	1.1%
S2020	Improve company ability to assess risks of new employees					1					1		3				2				7			7	1.3%
S2030	Practice Require demonstrated proficiency before solo operation to remote platforms													1							1			1	0.2%
S2040	Preliminary screening in simulator													1							1			1	0.2%
S2099	New Employees - Other																								0.0%
S3000	SOP - Ops Mgt																					106		106	20.3%
S3001	Develop pilot decision aid regarding Wx and alternate routing while inflight																		5		5			4	0.8%
S3002	Ensure company SOPs establish Wx ops minimums											2	2						7	1	12			12	2.3%
S3003	Establish company SOPs disallow flying in adverse Wx at night except under IFR																		1		1			1	0.2%
S3004	Establish SOP / procedure for continuing from interrupted checklist event	1											1		1						3			3	0.6%
S3005	Establish HOMP monitoring program		1	2	2	2	1		1		1		3			1	4		1		19			19	3.6%
S3006	Establish more comprehensive inflight communication for group movement of aircraft												1								1			1	0.2%
S3007	Establish more comprehensive preflight planning SOP for group movement of aircraft												1								1			1	0.2%
S3008	Establish policy to reduce risk of VFR into adverse Wx																1		6		7			7	1.3%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
S3009	Establish pre-approved designated LZ												1	1							2			2	0.4%
S3010	Establish preflight maneuver briefings			2	1																3			2	0.4%
S3011	Establish procedures to evaluate risk reduction benefits merits of installing optional equipment					1						1				2								4	0.8%
S3012	Establish refueling SOP that provides for proper refueling and fuel quantity measurement (of all fuel tanks)										4								1					5	0.8%
S3013	Establish risk assessment program that addresses the potential for VFR into adverse Wx and night flight ops					1													9					9	1.7%
S3014	Establish risk assessment program to address adverse Wx flight ops											1					2		1					4	0.8%
S3015	Establish SOP / procedure for remote ops pilots to ensure all preps complete before commencing startup for takeoff												1		1				1					3	0.6%
S3016	Establish SOP for selection of off airport or remote LZ				1				1					5										11	1.9%
S3017	Establish standardized training for platform ops/SOPs	1													1		1							3	0.6%
S3018	Hot/expedited loading SOP briefings and conditional situation checklists												3		2		1	1						7	1.3%
S3019	Implement a company flight following system to include updated Wx, location, risk eval				1													1	1	1				4	0.8%
S3020	Implement pilot/dispatch clrc procedures with rq'd items																		2					2	0.2%
S3021	Obtain standard Wx briefing												1	1										2	0.4%
S3022	Operator require pilot emphasis on proper checklist procedures										3		2			1	1		1					8	1.5%
S3023	Require proficiency check for low time helicopter pilots				1																			1	0.2%
S3024	Revise company checklist to be consistent with OEM checklist												2											2	0.4%
S3025	SOP requirement for landing site recon before landing at any remote site												4	4			2							10	1.7%
S3026	Standardized operational briefings and conditional situation checklists				1				1				1	1	1									5	1.0%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
S3027	Strengthen SOPs relative to gear loose in aircraft cabin															1					1			1	0.2%
S3028	WX training to emphasize mission abort in deteriorating WX conditions				1	2											1		3		7			7	1.3%
S3099	SOP - Ops Mgt - Other														1				1		2			2	0.4%
S4000	SOP - Ops Pilot																					110		110	21.0%
S4010	SOP directed preflight planning procedures		1	1	3						2		11	1	2	1	2				24			23	4.4%
S4020	Enforce use of published preflight planning procedures										3		3				1		1		8			8	1.5%
S4030	Insure adequate consideration is given to Wx during preflight planning												7	1					7		15			14	2.7%
S4035	Formal Preflight Briefing Guide for flight procedures			1	3	2							14			1					21			19	3.6%
S4040	Conduct site reconnaissance at safe altitude				1								2	3							12			11	2.1%
S4050	Conduct a ground survey for an unimproved field site prior to being used for autorotation training			1	4																5			4	0.8%
S4060	Training and recognition on suitable landing site selection	1		1	1								1	11			2		1		18			18	3.4%
S4070	Decision making training for operations in wind												5		1		3	1			10			10	1.9%
S4080	Increase nearby hazard awareness		1										1	1					1		10			10	1.9%
S4090	Clean glare free windscreen fundamental checklist item for Ag ops																1				1			1	0.2%
S4099	SOP - Ops Pilot - Other												1	1							2			2	0.4%
S5000	SOP - MX																					3		3	0.6%
S5010	Terminate FCF test when acceptable parameters exceeded												1								1			1	0.2%
S5020	Adopt civil aircraft Mx standards and applicable ICA's for public use aircraft															1					1			1	0.2%
S5030	Follow requirements laid out in the flight manual - install both particle separator and deflector											1									1			1	0.2%
S5099	SOP - MX - Other																								0.0%
S6000	SOP - Mission Specific																					19		19	3.6%
S6010	Establish operator SOP to ensure functional preflight of mission equipment	1							1				1			4					7			6	1.1%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level 1)	Accident Count (No Dups)	Accident %
S6015	Establish SOP for Night Vision Google operations																		2		2			2	0.4%
S6020	Improved power/performance margin planning for specific mission												7	1							8			8	1.5%
S6099	SOP - Mission Specific - Other		1		1								1								3			3	0.6%
S7000	SOP - Compliance																					31			0.0%
S7010	Enforce company SOP								2									1	2		5			4	0.8%
S7020	Establish oversight to ensure compliance with published procedures in AFM			2							2		7			7			1		19			18	3.4%
S7030	Operator require pilot emphasis on proper preflight check procedures										3		1			3					7			7	1.3%
S7040	Follow SOPs for departing into wind												2								2			2	0.4%
S7099	SOP - Compliance - Other														1						1			1	0.2%
S8000	Risk Assessment/Management																					178		178	34.0%
S8005	Establish/Improve Company Risk Management Program	1	2	3	5				1				13	1	1		1		11		39			34	6.5%
S8010	Use Operational Risk Management Program (Preflight)	1		2	3				1		1		14	2	1	4	5		3		37			33	6.3%
S8020	Use Operational Risk Management Program (Inflight)	1			2	2					2		6	3		1	10		3		30			30	5.7%
S8030	Establish/Improve Maintenance Risk Management Program												1			4					5			5	1.0%
S8040	Mission Specific Risk Management Program			2	4	2			2		3		14	2	1	1	16		2		49			42	8.0%
S8050	Personal Risk Management Program (IMSAFE)	1	3	1	6	2					5		21	1	1		13	1	5		60			54	10.3%
S8060	Enforce Compliance with Risk Management Program																								0.0%
S8099	Risk Assessment/Management - Other												1								1			1	0.2%
S9000	Safety Culture																					35		35	6.7%
S9010	Establish risk assessment program to eliminate culture of non-compliance		1						4		2	1	6			3	4	2	2		25			24	4.6%
S9020	Proactive correction of known safety risks	1									1	1	3		1	1	1		1		10			10	1.9%
S9030	Periodic Safety Audit of heliport	1											1								2			2	0.4%
S9099	Safety culture - Other														1						1			1	0.2%
T0000	Training/Instructional																						545	545	104.2%
T1000	Basic Training																					165		165	31.5%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level 1)	Accident Count (No Dups)	Accident %
T1010	Enhanced Aircraft Systems Training			1	6						1		2			4					14			14	2.7%
T1020	Enhanced Aircraft Performance & Limitations Training		4		3				1		4		28	1		1	3				45			41	7.8%
T1030	Enhanced Mission Planning Training			1							11		6						4		22			21	4.0%
T1035	Aircraft Preflight Procedures		1							1	1		8			12			3		26			25	4.8%
T1040	Ground Hazard Awareness/Proximity Training	1							1				3	3	1		7				16			16	3.1%
T1050	Inflight Power/Energy Management Training			1	8								24			2					35			34	6.5%
T1060	Simulator Training - Basic Maneuvers				9							1	18	1		1					30			29	5.5%
T1099	Basic Training - Other		1										3			1					5			5	1.0%
T2000	Advanced Maneuver Training																					221		221	42.3%
T2010	Autorotation Training Program		1	3	57								7				2				70			68	13.0%
T2020	LTE Training Program			2									39								41			27	5.2%
T2030	Inadvertent IMC Training					3											3		15		21			19	3.6%
T2040	Dynamic Rollover Training												27	1			2				30			29	5.5%
T2050	Emergency Procedures Training			1	6			1	1	1			18	1		7	1				37			37	7.1%
T2060	Simulator Training - Advanced Maneuvers			3	28								24	2		1	1		4		63			60	11.5%
T2099	Advanced Maneuver Training - Other												3								3			3	0.6%
T3000	CFI Training																					82		82	15.7%
T3010	Improve preflight planning / briefings				5								5				1				11			11	2.1%
T3020	Training and Refresher training on advanced handling techniques / cues / procedures for CFIs		1	3	6								18								28			26	5.0%
T3030	CFI judgment and decision making training to follow student more closely		2	3	14								18								37			36	6.9%
T3040	CFI training to take charge despite age or total exp differences			1									3								4			3	0.6%
T3050	CFI utilization of Risk Management techniques		1		1								4								6			5	1.0%
T3060	Change training program to improve safety margin		1		3								8								12			12	2.3%
T3070	Increase CFI training on cues for low RPM, airspeed issues			2	6								12								20			18	3.4%
T3080	Require CFI endorsement for advanced maneuvers by students												2								2			2	0.4%
T3099	CFI Training - Other		1	1	1								1								4			4	0.8%
T4000	M/M transition																					53		53	10.1%
T4001	Application of risk assessment model, currency requirement				1								2	2							5			5	1.0%

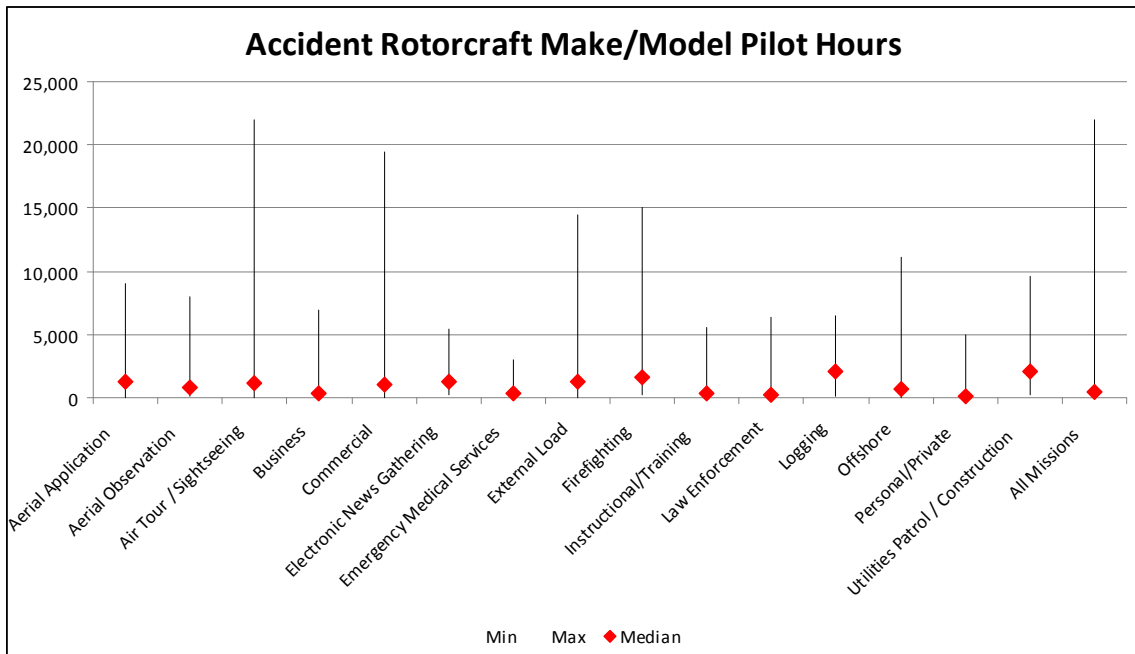
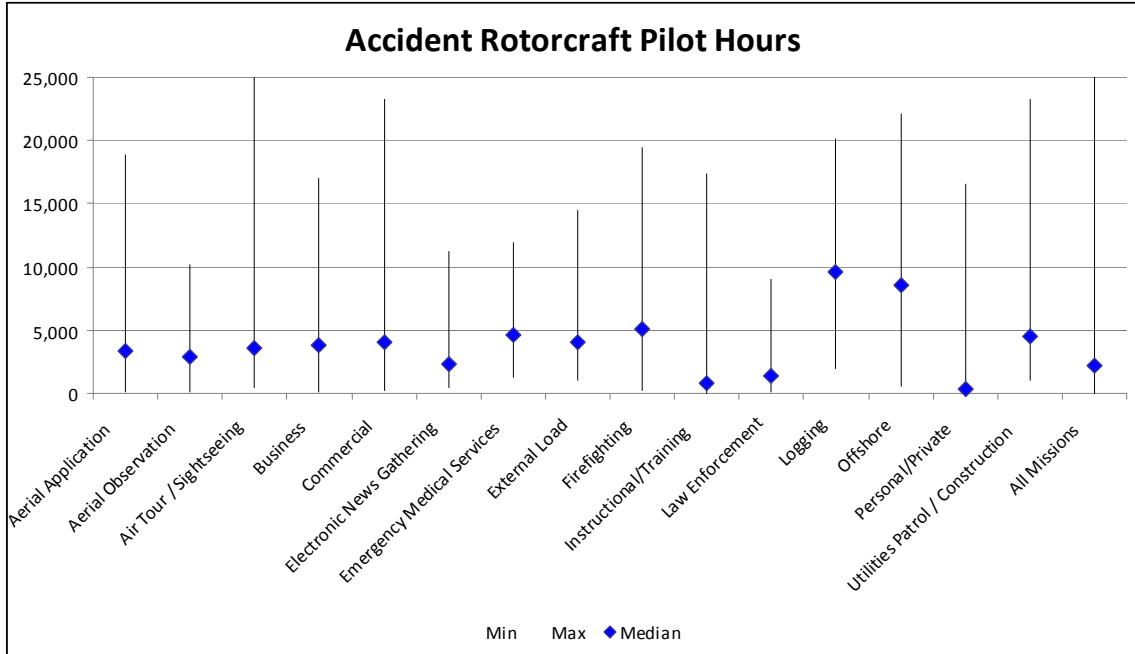
Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %	
T4002	Classroom and in type sim training		1		1								5									7			6	1.1%
T4003	Ensure use of adequate transition training program				3								2			1						6			6	1.1%
T4004	Establish new equipment training program				1	1							2									4			4	0.8%
T4005	Model specific sim training for low time in type pilots												2						1			3			3	0.6%
T4006	Model specific transition training		1	1	3								7				1					13			12	2.3%
T4007	Require systems familiarization, increased requirements for M/M transition training										2		6			1						9			9	1.7%
T4010	Specialized training for pilots migrating from fixed to rotor wing aircraft				3						1		5									9			9	1.7%
T4011	Systems familiarization, increased requirements for transition training from turbine to piston										1											1			1	0.2%
T4012	Type familiarization pilot training										1											1			1	0.2%
T4013	Use pilot handbook/guide for mission planning, risk assessment Handbook could be aircraft/engine class specific (single/piston, etc)																									0.0%
T4060	Simulator training - M/M specific		1		1								7									9			7	1.3%
T4099	M/M transition - Other																									0.0%
T5000	Mission specific																						83		83	15.9%
T5001	Company- Ensure new pilot training includes Back to Basics elements and a mandatory review of the Rotorcraft Flying Handbook										1		1									2			2	0.4%
T5002	Company new employee ops training												2						1			3			2	0.4%
T5003	Enhanced training in type of maneuvers being performed in this operation				1	1			1				9	1		1	1		1			16			15	2.9%
T5004	External load / LZ training								1				1				3					5			4	0.8%
T5005	Insure adequate training on aircraft operations in snow											3	1						3			7			6	1.1%
T5007	Mission specific training focused on wind, night, low, slow, at or near maximum gross weight and orbiting			1									7						2			10			10	1.9%
T5008	Operational training for known hazards in event area				3				1				2		1		3		3			13			12	2.3%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %
T5009	Proficiency training night aerial application and landings			1																	1			1	0.2%
T5010	Push "mission specific" best practice info into existing company training programs for elevated helipads	1															1				2			2	0.4%
T5011	Push "mission specific" best practice into existing company training program								2				4	2	1		2		3		14			13	2.5%
T5012	Push "nearby object awareness" best practice info into existing company and customer training programs													2			4				6			5	1.0%
T5013	Require proper training and proficiency before allowing pilots taking off and landing on trailers/dolly. Add to Basic Helicopter Handbook												1								1			1	0.2%
T5014	Standard approach training for rooftop helipads												2								2			1	0.2%
T5015	Training in long line SOPs								1				2								3			2	0.4%
T5016	Training in mountain flying												9				1				10			8	1.5%
T5017	Training in recovery from settling with power situations and the hazards of landing and or maneuvering in tailwinds and mountainous terrain												6								6			6	1.1%
T5060	Simulator Training - Mission Specific Training				1	1		1					1						1		5			5	1.0%
T5099	Mission Specific - Other																								0.0%
T6000	Safety Training																					201		201	38.4%
T6001	ADM training				2				2		1		6	2		1	6	1	5		26			26	5.0%
T6002	AMRM training and utilization(AC00-64)												2	3			2		1		8			8	1.5%
T6005	CRM training				2	1			1				4	1	1		3		1		14			14	2.7%
T6006	Develop a "Rotorwings" program similar to the "Wings" program												1	1			1				3			3	0.6%
T6007	Flight training on common operational pilot errors			2	1	1					2		8	1		1	1		2		19			19	3.6%
T6008	Increase student training on cues for low RPM airspeed issue				1								3								4			3	0.6%
T6009	Mission specific risk assessment training								1				2		1				1		5			5	1.0%
T6010	Mission specific risk assessment training - Ag Ops			1									1				7	1			10			9	1.7%

Code	Intervention Recommendation	ADRM	AMAN	ARC	AUTO	CFIT	Data	DITCH	EXTL	FIRE	FUEL	ICE	LOC	LZ	RAMP	SCF	STRIKE	UNK	VIS	WSTRW	Count (Level 3)	Count (Level2)	Count (Level1)	Accident Count (No Dups)	Accident %	
T6011	Mission specific risk assessment training - EMS dispatch/comm center personnel																								0.0%	
T6012	Mission specific risk assessment training - external load				1				5							2						8			6	1.1%
T6013	Mission specific risk management training				1						1		2			1			1			6			6	1.1%
T6014	Pit judgment training risk assessment		1			1						1	4	3	1	2	2					15			15	2.9%
T6015	Precautionary landing decision making training				2								1	1			3					7			7	1.3%
T6016	Recurrence training												1			1						2			2	0.4%
T6017	Risk assessment/management training	1	1	1	2	1					5	1	5	2		2	7		8			36			28	5.4%
T6018	SMS specialized EMS ADM training					1													2			3			3	0.6%
T6019	Training emphasis for maintaining awareness of cues critical to safe flight		1	2	5	2			1		3		22				6		5			47			47	9.0%
T6020	Training emphasis on techniques for maintaining visual alertness	1	1			1							2	1	1		2		1			10			10	1.9%
T6021	Training emphasis on techniques for maintaining visual contact					2							1	1			1		4			9			9	1.7%
T6022	Training for awareness of flight time/waypoint progress										2							1				3			3	0.6%
T6023	Training on optimum aircraft operating regimes during an emergency situation				3			1					3									7			6	1.1%
T6099	Safety Training - Other		1			1				1			1		1							5			5	1.0%

Appendix F – Pilot Flight Times

Pilot Flight Times “All Accidents”

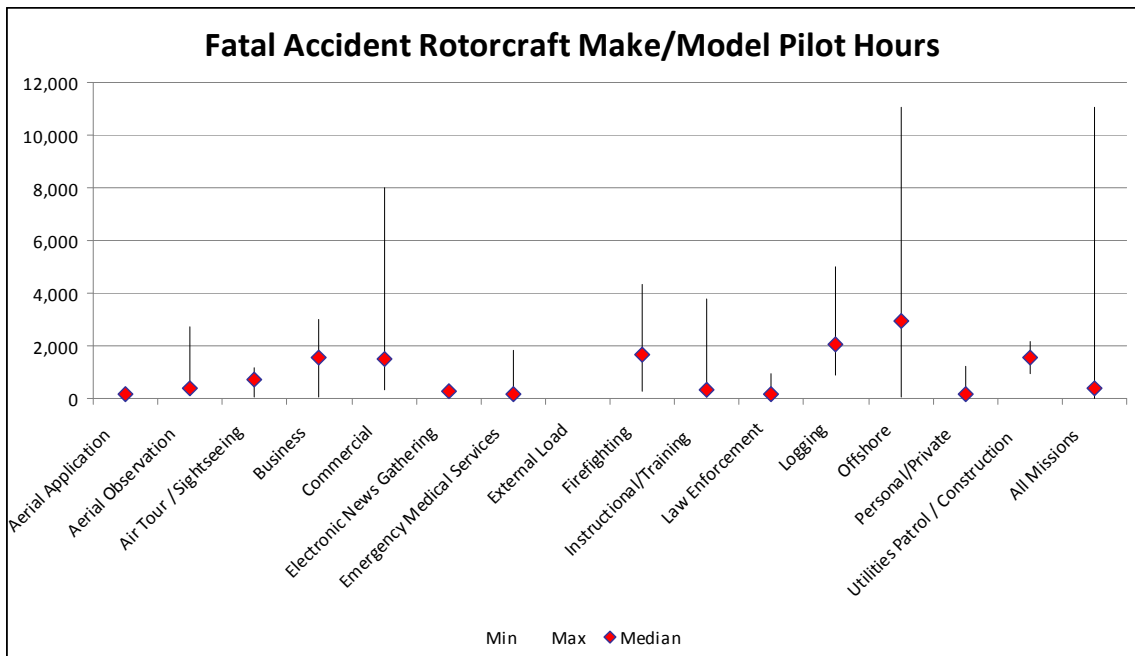
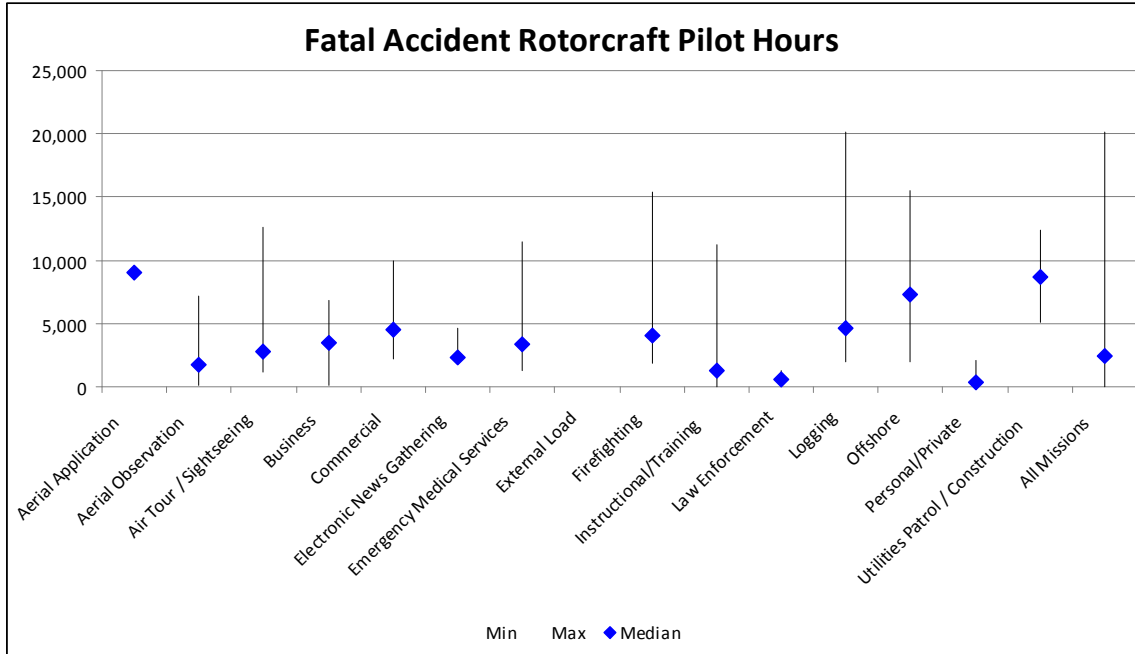


Data for "All Accidents"

	Accident Count	Rotorcraft Pilot Hours					Make / Model Pilot Hours				
		Pilots	Min	Median	Average	Max	Pilots	Min	Median	Average	Max
Aerial Application	54	44	111	3,365	5,407	18,850	50	10	1,263	2,319	9,000
Aerial Observation	21	20	114	2,946	3,931	10,163	20	87	798	1,790	8,000
Air Tour / Sightseeing	31	29	493	3,630	5,758	25,000	29	7	1,187	2,628	22,000
Business	26	20	157	3,824	5,560	16,972	20	14	378	895	6,963
Commercial	39	32	174	4,096	5,679	23,300	36	8	1,015	2,575	19,500
Electronic News Gathering	9	9	460	2,291	3,991	11,250	8	233	1,246	1,762	5,470
Emergency Medical Services	40	38	1,328	4,628	5,566	11,876	38	3	323	686	3,000
External Load	14	9	1,051	4,100	6,598	14,500	12	48	1,253	3,171	14,500
Firefighting	19	17	227	5,150	6,624	19,500	19	200	1,631	2,609	15,000
Instructional/Training	92	88	13	800	2,199	17,400	85	13	357	761	5,586
Law Enforcement	34	33	149	1,350	2,369	9,026	31	2	277	826	6,350
Logging	14	12	2,000	9,576	9,473	20,150	12	90	2,073	2,736	6,500
Offshore	22	19	606	8,608	9,293	22,107	22	26	714	1,792	11,070
Personal/Private	97	79	23	384	1,184	16,550	80	2	157	398	5,000
Utilities Patrol / Construction	11	10	1,090	4,468	6,411	23,239	10	216	2,034	2,622	9,647
All Missions	523	459	13	2,249	4,173	25,000	472	2	500	1,455	22,000

Note: Pilot Flight Time was not available in all NTSB Accident data.

Pilot Flight Times “Fatal Accidents”



Data for "Fatal Accidents"

	Accident Count	Rotorcraft Pilot Hours					Make / Model Pilot Hours				
		Pilots	Min	Median	Average	Max	Pilots	Min	Median	Average	Max
Aerial Application	4	1	9,000	9,000	9,000	9,000	1	150	150	150	150
Aerial Observation	6	6	114	1,744	2,378	7,142	5	87	410	877	2,699
Air Tour / Sightseeing	3	3	1,187	2,794	5,535	12,625	3	56	699	647	1,187
Business	2	2	157	3,507	3,507	6,856	2	73	1,537	1,537	3,000
Commercial	7	7	2,250	4,500	5,040	10,000	7	350	1,485	2,307	8,000
Electronic News Gathering	3	3	1,819	2,291	2,928	4,674	3	233	251	337	526
Emergency Medical Services	10	10	1,328	3,342	4,558	11,413	9	3	169	508	1,859
External Load	0	0					0				
Firefighting	7	7	1,893	4,000	6,662	15,406	7	300	1,640	2,527	4,306
Instructional/Training	7	6	30	1,296	3,503	11,200	6	29	326	912	3,800
Law Enforcement	5	5	149	534	611	1,299	5	144	149	318	923
Logging	4	4	2,000	4,679	7,877	20,150	4	897	2,073	2,511	5,000
Offshore	4	4	1,984	7,276	7,997	15,454	4	58	2,928	4,246	11,070
Personal/Private	19	15	23	350	557	2,035	13	23	152	284	1,200
Utilities Patrol / Construction	3	2	5,090	8,734	8,734	12,377	2	940	1,543	1,543	2,146
All Missions	84	75	23	2,400	3,954	20,150	71	3	410	1,265	11,070

Note: Pilot Flight Time was not available in all NTSB Accident data.

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GOAL - THE IHST HAS SET AN AGGRESSIVE GOAL OF REDUCING THE WORLDWIDE CIVIL HELICOPTER ACCIDENT RATES BY 80% IN 10 YEARS.



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