The "Break-Off" Phenomenon

A Precipitant of Anxiety in Jet Aviators

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. . . . Icarus, flushed with excitement and exhilaration, soared even higher toward the sun—despite the cries and warnings of his father. At last he flew so high that the heat of the sun melted the wax, and off dropped the wings.

CONTEMPORARY developments in bioastronautics have challenged the once held assumption that "man is a sea-level, low-speed, one G, 12-hour animal." [49] The physical dangers of space flight for the astronaut previously anticipated with uncertainty, have thus far been technologically overcome.[2,4,7,9] But even after the successes of recent short-term space explorations,[26,27] the question of man's capacity to withstand the emotional and psychological effects of sensory isolation and deprivation is not fully answered.* It is now thought, however, that the use of two-man teams will obviate in large part the hazards of acute sensory deprivation.[52]

In 1957, Clark and Graybiel found in their study of the "break-off" phenomenon that sensory isolation and confinement are stresses even for jet aviators flying at the upper margins of military aviation.[8] They characterized the "break-off" phenomenon as a feeling of physical separation from the earth experienced by jet aviators flying alone at high altitudes and relatively unoccupied with flight details. In their study "break-off" experiences were reported by 35% of jet aviators flying above 13,000 feet. Clark and Graybiel found that some jet aviators reported feelings of detachment, exhilaration, and exalted power, as well as vivid fantasies and dreamy twilight states, which they had regarded as pleasurable. A few aviators had even been enthralled by their "break-off" experiences, and they described them as blissful reveries. On the other hand, 13% indicated that they had endured highly unpleasant affects, thoughts, and perceptions: loneliness, anxiety, giddiness, bewilderment, spatial disorientation, depersonalization, derealization, and pseudohallucinations.

Causative factors thought to be associated with the "break-off" phenomenon were identified as those of isolation, high altitude, relative unconcern with routine operational flight details, acrobatics, and physical debilitation.[3,8,24,32,38,45] Frequently aviators attributed their "break-off" experiences to "having time on (their) hands with little to do" during an uneventful flight. Efforts at becoming involved in some operational aspect of flying, such as scrutiny of instruments, joining up with another aircraft, or returning to a lower altitude, abolished these unpleasant affects and perceptions. Any task which called on a major part of the aviator's attention seemed to relieve "break-off" experiences. As suggested by the anecdotal reports of solitary night drivers, radar observers, and oceanauts who had experienced various mental symptoms during isolation and confinement, the maintenance of vigilance appeared to be an essential deterrent to the "break-off" phenomenon.

Clark and Graybiel suggested that the "break-off" phenomenon is related to personality factors, as well as those of high altitude, isolation, and monotony. The results of their study indicated that the phenomenon is most apt to be encountered by emotionally unstable individuals.[8] In another similar study of aviators, Bennett reported several instances of acute anxiety reactions

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TABLE 1.—*Jet Aviators With Positive Psychiatric*

No.	Age	Rank	Reason for Referral	Total Hours				Greatest Altitude	Greatest Speed	Break-Off Phenomenon	
				Prop	Jet	35-50,000 Ft	50,000+ Ft			Other Aviators	Personal Experience
1	25	1/Lt USMC	Evaluation	550	750	350	0.00	50,000	1.65 M †	No	Yes
2	20	NavCad	SBFS *: Renal	37	2,000	350	0.00	47,500	1.20 M	No	No
3	40	LCdr	SBFS: Eye	2,100	400	200	0.00	49,000	1.00 M	No	No
4	28	Capt USMC	SBFS: NP	176	830	800	0.00	43,000	1.30 M	Yes	Yes
5	41	LCdr	Evaluation	4,775	25	2	0.00	40,000	250 K	No	No
6	37	Cdr	SBFS: NP, med	2,800	1,700	500	0.16	52,000	1150 K	Yes	Yes
7	32	Lt	SBFS: NP	400	1,000	200	0.00	40,000	1.20 M	No	No
8	42	LCdr	SBFS: NP, med	3,600	100	300	4.00	52,000	650 K	Yes	Yes
9	30	Lt	SBFS: Eye	1,930	91	5	0.00	35,000	550 K	No	No
10	39	LCdr	SBFS: Eye	2,636	871	100	5.00	72,000	2.10 M	Yes	Yes
11	31	Lt	SBFS: NP, Eye	1,100	650	100	10.00	52,800	1.40 M	No	No
12	25	Ens	Evaluation	40	315	10	0.00	46,000	1.30 M	No	No
13	36	LCdr	Evaluation	900	2,800	1,000	5.00	55,000	1.90 M	No	No
14	37	LCdr	Evaluation	1,600	1,400	1,000	0.00	50,000	1.90 M	No	No
15	30	Lt	Evaluation	500	1,650	600	2.00	55,00	2.37 M	Yes	Yes
16	31	LCdr	Evaluation	500	1,750	400	2.00	65,000	2.20 M	No	No
17	31	Capt, USMC	Evaluation	1,350	1,365	375	25.00	62,000	2.20 M	No	No

* SBFS, Special Board of Flight Surgeons.
† M indicates mach and K, knots.

occurring in emotionally unstable aviators flying alone at high altitudes.[3] He attributed their panic reactions to solitary high altitude flying which, he thought, had been "a precipitant factor in the development of (their) anxiety state."[3] No explanation, however, was given for aviators who had encountered "break-off" experiences without significant concomitant anxiety, diminution in flight performance, or motivation for flying.

The purpose of this study was to delineate further the phenomenology and frequency of the "break-off" phenomenon in experienced jet aviators. The role of personality factors in the precipitation of "break-off" experiences was assessed. It was postulated that the "break-off" phenomenon can precipitate an acute anxiety attack with phobic and psychophysiological manifestations and lead to the development of a fear of flying reaction.[4,9] As a corollary, it was also postulated that the "break-off" phenomenon occurs more often in jet aviators with emotional and personality disorders. In addition, the "break-off" phenomenon is more apt to be reported by experienced jet aviators who have greater contact with high altitude solitary flying.

The findings are discussed in relation to the proposed postulates and the psychiatric disorders encountered in aviation medicine. Pertinent psychological and psychiatric literature is cited.

Method

During a six-month interval in 1962 all designated naval and marine jet aviators referred for neuropsychiatric consultation were questioned in regard to the "break-off" phenomenon. In some instances they had been referred by the Bureau of Medicine and Surgery to the Special Board of Flight Surgeons (SBFS) for evaluation of a medical disorder first diagnosed by a flight surgeon in the fleet.[28,30] The other aviators had been administratively referred for a comprehensive medical evaluation in order to determine their overall medical eligibility for advanced technological training. These aviators had been selected because of previous accomplishments in technical and performance aspects of jet aviation; selection had not been made on the basis of flight time logged in jet flying.

Each aviator was routinely evaluated in an open-ended psychiatric interview. A psychological test battery was administered to the 11 aviators referred for comprehensive medical evaluation. Only when indicated was the battery given to aviators referred to the SBFS. Psychological tests consisted of the Human Figure Drawing, Rorschach Psycho-Diagnostic Test, and Minnesota Multiphasic Personality Inventory (MMPI). Prior to psychiatric interview, each aviator completed an unofficial aviation research questionnaire,† detailing various facets of flight performance and experience, as well as awareness of and personal familiarity with the "break-off" phenomenon.

Results

During the period of study, 37 jet aviators were evaluated. Analysis of the data revealed that they could be divided into two groups on the basis of presence or absence

† Captain Ashton Graybiel, MC, USN, Director of Research, US Naval School of Aviation Medicine, Pensacola, Fla, allowed use of the questionnaire which he devised for his study of the "break-off" phenomenon.[8]

Findings, N=17

Diagnosis
Acute anxiety reaction
Hydronephrosis: obessional personality
Glaucoma; passive-dependent personality
Obsessional personality, syncope, psychogenic
Alcoholism, passive-aggressive personality
Acute anxiety reaction
Neurotic depressive reaction
Acute anxiety reaction
Obsessional personality: myopia
Obsessional personality: retinal arteriolar spasm OD
Exotropia, VA complaint: conversion reaction
Neurotic character disorder
Ulcerative colitis: Cyclothymic personality
Obsessional personality
Labile hypertension: passive-aggressive personality
Heterophoria: schizoid personality
Paranoid personality

of significant psychopathology. In regard to the group of aviators with psychopathology Table 1 indicates that there were 17 aviators (46%) with psychiatric findings. These findings included the following: acute anxiety reactions, neurotic depressive reaction, visual conversion reaction, neurotic character disorder, psychogenic syncope, chronic alcoholism, and a variety of personality disorders. The second group—aviators with no significant psychopathology—was noted to have various medical findings and disorders (Table 2). General medical and specialty evaluations failed to reveal any medical findings in five aviators.

Comparison of the two groups of aviators (Tables 1 and 2) shows that of the 17 aviators with positive psychiatric findings there are six men who experienced the "break-off" phenomenon on at least one occasion. On the other hand, the second group of aviators (Table 2) was strikingly different in regard to the "break-off" phenomenon. Two aviators in group 2, however, were familiar with the "break-off" phenomenon, one of whom had had such an experience while flying at high altitude. He found the "break-off" phenomenon "exhilarating"; he recalled that he had been acutely aware of himself and the aircraft and had desired intensely to fly even higher. His euphoria, however, had been tempered by the awareness that giving way to such a whim would have taxed the capabilities of his aircraft. Psychiatric evaluation of this aviator failed to reveal any deficits in ego organization. Both aviators had been raised in nurturant homes where they were exposed to healthy parental models for identification. These aviators expressed satisfaction with their gender role and self-image, and their self-esteem was congruent with their overall sense of competence.

Only one aviator in the group with positive psychiatric findings (Table 1) had found the "break-off" phenomenon entirely pleasurable. He stated that his several "break-off" experiences had given him a desire to fly "higher and faster," had markedly alerted him and forced him to assume greater control of the aircraft. He further revealed that when flying alone at high altitudes he felt aggressive and invulnerable. "Flying high makes me feel like a 'real tiger.'" Psychiatric evaluation demonstrated that this aviator shunned any degree of closeness in his interpersonal relationships. On the ground, he was, in general, aloof from and cautious with people, reluctantly expressing anger even when justified in realistic circumstances. His passive-aggressive traits were most marked in his transactions with superior officers. During his overall medical evaluation he was tense, apprehensive, unassertive, and acutely aware of the competitive situation—factors thought to be partly responsible for his labile blood pressure.

Another aviator, an intellectual and obsessional individual, referred to the SBFS because of retinal arteriolar spasm, also described his "break-off" experiences as pleasurable to a point. "It's hard to describe . . . almost like leaving the world of 'mortals' and sensing you're indestructible; but you know it's not true." He remarked that the "break-off" experience became alarming after a point; it would then make him "jumpy and too alert." He would then reassure himself that "everyone feels funny at high altitudes" and "try to forget it" by turning his attention to the immediate flying tasks before him.

Yet another aviator, evaluated for episodes of psychogenic syncope unrelated to operational flying, remarked that his reaction to high altitude solitary flying had been solely one of increased arousal without any awareness of anxiety. His use of denial and isolation, although quite effective for flying

TABLE 2.—*Jet Aviators With Negative Psychiatric*

No.	Age	Rank	Reason for Referral	Total Hours				Greatest Altitude	Greatest Speed
				Prop	Jet	35-50,000 Ft	50,000+ Ft		
1	40	Major, USMC	SBFS: Cardiac	5,000	2,000	350	0.00	47,500	1.20 M †
2	38	Cdr	SBFS: NP	3,500	50	20	0.00	42,000	0.98 M
3	26	NavCad	SBFS: Med	30	100	0	0.00	12,000	350 K
4	41	Cdr	SBFS: Med	3,950	191	20	0.00	42,000	1.00 M
5	42	Cdr	SBFS: Med	4,590	10	9	0.00	40,000	1.10 M
6	29	Lt	SBFS: NP	2,100	100	30	0.00	45,000	1.00 M
7	25	Lt	SBFS: Eye	800	1,050	600	0.25	51,000	1.40 M
8	39	Major, USMC	SBFS: Cardiac	3,300	160	20	0.00	43,000	1.00 M
9	38	LtCol, USMC	SBFS: Eye	3,505	630	250	0.00	50,000	1.50 M
10	24	Ens	SBFS: Eye	30	300	210	0.00	43,000	1.20 M
11	32	Lt	SBFS: Eye	2,800	200	50	0.00	42,000	600 K
12	23	Lt (jg)	SBFS: Eye	1,250	27	15	0.00	40,000	800 K
13	32	Capt USMC	SBFS: NP	2,400	300	3	0.00	42,000	500 K
14	27	Lt	SBFS: NP	1,150	25	0	0.00	32,000	400 K
15	34	LCdr	SBFS: Cardiac	3,270	550	350	0.00	46,000	1000 K
16	40	Cdr	SBFS: NP	3,700	1,000	800	5.00	56,000	2.1 M
17	32	Lt	Evaluation	2,800	350	250	0.00	45,000	1.95 M
18	34	LCdr	Evaluation	2,500	1,300	700	2.00	80,000	2.20 M
19	37	Cdr	Evaluation	960	1,116	500	15.00	71,000	2.10 M
20	36	Major, USMC	SBFS: Cardiac	2,200	50	50	20.00	45,000	0.94 M

* SBFS, Special Board of Flight Surgeons.
† M indicates mach and K, knots.

stresses, had failed him in a hostile, dependent relationship with his wife.

On the other hand, the remaining three aviators reporting "break-off" experiences had been patently upset by them. They described them as "dreamy states." One aviator was referred because of frequent anxiety attacks with hyperventilation occurring both on the ground and in flying. He had observed that prior to the onset of acute symptoms he had first noticed anxiety while flying alone at high altitudes. Several months later he developed acute anxiety after take-off for what was to be a short flight at low altitude. Two aviators had acute anxiety attacks with hyperventilation symptoms while flying at high altitudes. There was no indication that they had hyperventilated to the point of hypoxia. Preceding the attacks they had been keenly aware of intense loneliness, isolation, and a sense of "being out of reach." They had initially described their reactions to the flight surgeon in terms of shortness of breath. Thorough check of oxygen equipment and carbon monoxide hazards was unrevealing. They were then referred for medical evaluation of possible bronchial asthma. Diagnostic evaluation including pulmonary function studies failed to demonstrate any pathophysiological explanation for their shortness of breath at high altitudes. In the course of several months their anxiety had spread to all flying situations. These aviators had developed neurotic reactions to flying which had been precipitated in part by solitary flying.

The following clinical vignette illustrates the insidious onset of anxiety in solitary flying which occurred after the aviator had been given command of a fighter squadron.

A 37-year-old, married Commander was referred to the Special Board of Flight Surgeons because of a history of bronchial asthma associated with flying. He first experienced difficulties with breathing while he was at the Naval Air Station, Corpus Christi. He was told by a medical officer that his "asthmatic" breathing was probably due to climatic conditions, although he had similar symptoms several years before while in a dry climate. He was subsequently guarded in discussing his symptomatology with medical officers for fear that his medical problem might jeopardize his aviation career.

He thought that he had had his first significant difficulty in regard to breathing in 1956, when at the altitude of 45,000 feet he had experienced a frightening feeling of detachment which he later ascribed to the "break-off" phenomenon. He then attributed this difficulty, however, to "insufficient oxygen." While on a crosscountry flight in 1957 in a F9F-AP, he again noted shortness of breath which he related to hyperventilation. Because of several similar episodes in flying a F9F at high altitudes he preferred to fly at lower altitudes.

After an enjoyable tour of duty at the Armed Forces Staff College, he reported to a fighter squadron as commanding officer. He was sent immediately for carrier qualifications. He again noticed difficulty in breathing at high altitudes. This caused him a great deal of anxiety with palpitations, dyspnea,

Findings, N=20

Break-Off Phenomenon		
Other Aviators	Personal Experience	Diagnosis
No	No	Abnormal EKG
No	No	Fracture L-3
No	No	Rheumatoid arthritis
No	No	HCVD
No	No	None
No	No	None
No	No	Myopia
No	No	Abnormal EKG
No	No	Myopia
No	No	Esophoria
Yes	Yes	Myopia
No	No	Myopia
No	No	Cerebral concussion
No	No	Syncope vasovagal
No	No	RHD, MI-compensated
No	No	Solitary seizure ? etiol
No	No	None
No	No	None
Yes	No	None
No	No	Abnormal EKG

and hyperventilation which resulted in very unsteady handling of the aircraft. Often he was concerned about getting his plane back safely. The patient indicated that because of his "breathing problem" he did not feel himself qualified to assume the responsibilities of commanding officer of the squadron. He was referred to a psychiatrist to whom he related the opinion that no psychological reason lay behind his reluctance to assume his new command or to fly at high altitudes. He once again stated that he thought a "breathing problem" was the main deterrent to his flying.

Complete medical evaluation did not reveal any significant cardiopulmonary findings. He was returned to his ship. When an opportunity to fly again was given to him, he declined because of "a knot in (his) stomach and not just feeling quite well." His symptoms persisted into the next day when he was again reluctant to fly because of a low ceiling and the possibility that he would have to go to high altitudes in order to return to the ship. The patient was then ordered to the Special Board of Flight Surgeons for further evaluation.

During the course of this psychiatric evaluation the patient attempted to control feelings of resentment and anger toward both his superiors and his peers. Frequently in the interview it was noted that at times of stress—particularly when he displayed angry feelings—he hyperventilated. He was unaware of his abnormal breathing until it was pointed out to him. It was further noted that he was moderately depressed. He felt "persecuted" because of his inability to fly at high altitudes, although he later remarked that flying in general had less interest for him and was less gratifying.

It was thought that the patient was ambivalent toward accepting a passive role. He had identified with a father, a caricature of masculine aggressiveness and abject ineffectuality. He had strong aggressive impulses which in the face of assuming command of a fighter squadron caused him considerable anxiety. On the other hand he was undecided whether to follow his aggressive impulses and risk the chance of acute distress and possible self-destruction at high altitudes or to assume a passive-reluctant role and face the prospects of further loss of self-esteem. Projective psychological tests demonstrated these contrapuntal impulses and strong feelings of masculine inferiority and damage for which the patient attempted to compensate through projection, coercive manipulation, and pseudoaggressivity. It was thought that the anxiety, no longer controlled by his defenses and previously high motivation, had given rise to hyperventilation symptoms. Medical consultants suggested that the patient had had in 1956 severe episodes of asthmatic bronchitis. There was, however, no historical evidence of cardiopulmonary findings to substantiate a diagnosis of bronchial asthma or emphysema.

In comparing the seven aviators who reported the "break-off" phenomenon with those who never had encountered such flying experiences, the only comparison which yields clear-cut results is the one for the greater incidence of the "break-off" phenomenon among aviators with positive psychiatric findings (Table 3). In this respect the difference between the two groups of aviators is significant ($P<0.05$). Thus the second hypothesis is verified. Whether the first hypothesis is also verified depends on psychiatric factors that can be attributed to the failure of the three aviators who developed fear of flying reactions. Since the three aviators were in the group with positive psychiatric findings, it is likely that the presence of emotional problems led to their failure by way of occurrence of the "break-off" phenomenon. In other words, the "break-off" phenomenon served only to precipitate an inevitable fear of flying. The "break-off" phenomenon per se is not a sufficient cause for anxiety in high altitude flying.

It was further postulated that the "break-off" phenomenon is apt to be reported by experienced jet aviators who have greater contact with high altitude solitary flying. Within each group of aviators, those who reported this phenomenon had more hours of flying propeller aircraft, less hours in jet aircraft, and less hours above 50,000 feet. For the other two measures, namely, hours in flight between 35,000-50,000 feet and greatest altitude, the means are crisscrossed. These results run counter to the predicted direction. In spite of this, had the third hypothesis been correct, the differences within the two groups would have been expected to lie in the opposite direction. It is thus quite unlikely that the third hypothesis is true.

TABLE 3.—*Comparison of Two Groups of Aviators in Regard to "Break-Off" Experiences at High Altitudes*

Jet Aviators	Mean Age	Flight Time				Total Flight Time	Highest Altitude	Maximal Speed
		Prop	Jet	35-50,000	50,000+ Ft			
Break-off experience reported, *N*=7	33.0	1,710.3	983.5	441.7	1.86	2,737	54,000	1.86 M * 800 K
Not reported, N=30	32.5	1,339.3	1,072.4	331.1	3.82	2,746	49,300	1.47 M 550 K

* M indicates mach and K, knots.

Comment

In the present study seven aviators reported the "break-off" phenomenon, three of whom had experienced varying degrees of anxiety. The incidence of the phenomenon in the present study is lower than that of previous studies.[8,24] Perhaps personal, procedural, or motivational variables can account for the difference. It is possible that the aviators studied elsewhere had flown for longer periods of time at high altitudes, with a greater reduction in awareness.[8] This might account for the higher incidence of the phenomenon, as well as the frequency of altered states of consciousness and depersonalization. The anxiety associated with psychiatric evaluation may have led the aviators to suppress information for fear that reports of unusual affects and perceptions might put their careers in jeopardy. It is also possible that in order to identify the "break-off" phenomenon it is necessary for an aviator to have heard or read about it. It is conceivable that knowing about the phenomenon can foster its occurrence by suggestion.[22,23,31]

Again comparing the results of this study with previous investigations [3,8,24] other phenomenological differences are apparent. In several studies mental confusion and altered states of consciousness, varying from obnubilation to unconsciousness, were found. In the present study there were no reported instances of pseudohallucinations, dreams, confusion, or loss of consciousness. The predominant findings were affective, either arousal or exhilaration resulting in a desire to fly higher or faster; or, on the other hand, reduced awareness, apprehension or frank anxiety associated with feelings of detachment, isolation, or physical separation. Not one aviator reported actual spatial disorientation.

Why should these more severe perceptual and cognitive disturbances have been reported in other studies? For instance, one study reports five aviators who had developed altered states of consciousness with akinesia and mutism.[45] One suspects that variables over and above those of altered sensory input are involved. When acrobatics preceded the onset of symptoms, G-effects could have been operative, as well as those of fatigue and hypoglycemia.[40,46,47] It is also conceivable that aviators reporting severe "break-off" experiences had hyperventilated to the point of hypoxia and diminished consciousness, Hyperventilation states leading to hypoxia and the psychophysiological aberrations connected with G-intolerance syncope can result in disturbances of consciousness with depersonalization and derealization.[29,36,42]

The affective accompaniments of the "break-off" phenomenon seem to be the most important effects of this type of altered sensory input situation. As a sensory deprivation experience, the effects of solitary flying are not as far-reaching as those of experimental situations in which the level of intensity or patterning of sensory stimuli is maximally reduced.[19,31,39] As an experimental model the "break-off" phenomenon comes closest to resembling an altered sensory environment in which there is a reduction of patterning and organization of sensory input.[48,52,53]

The jet aviator flying straight and level has little to do, particularly if the aircraft is well-trimmed. Movement within the aircraft is limited to slight variations in the instruments. There is minimal sensation of speed at high altitudes. In flying straight and level in nonturbulent air there is little exogenous stimulation of the otolith and semicircular canal systems. The aviator is secured to his seat in heavy clothing and accoutrements, has a limited view of the aircraft's wings and nose, is subjected to monotonous background white noise of the

jet engine, and oxygen equipment and has a relatively unvarying view from his "canopy in the sky." The aviator is thus exposed to a reduction in patterning and organization of sensory input, while at the same time subjected to greater than usual stresses of military flying.

The "break-off" phenomenon, therefore, can be regarded as an attenuated perceptual deprivation experience fostering varying degrees of wakefulness and awareness. Little research, however, has been done in terms of specific effects of perceptual deprivation over several hours duration.[51] Furthermore, the reported effects attributed to short-term sensory input patterning have been questioned.[22,52,53] Studies of eye-patched subjects suggest that reduced awareness is the necessary but not sufficient cause of the symptoms of sensory deprivation.[46,52] Shurley has challenged this viewpoint by stating that the mental symptoms of sensory deprivations occur in alert consciousness.[52]

In the present study high altitude is not the necessary condition for the occurrence of acute anxiety in flight. Furthermore, acute anxiety attacks occur in a variety of solitary flying situations where there is no significant alteration of sensory input, awareness, and wakefulness. In addition, these anxiety attacks are not appreciably different from those precipitated by the "break-off" phenomenon.[6,41,42]

A report of a student naval aviator, evaluated independently of this study, is revealing in this respect.

This 23-year-old ensign was referred for psychiatric evaluation because of anxiety and tension related to flying above 10,000 feet with heavy cloud layers beneath. He had become anxious when he "realized for the first time how high (he) was." The acute anxiety attack dated from his first flying experience in an 0.8 cloud coverage with clouds ranging from 3,500 to 13,000 feet. This flight made him apprehensive and short of breath, because "the clouds were (his) only visual reference point; otherwise, (he) was lost." He had previously flown 30 hours in the T2J.

He asserted that on the day of the acute anxiety attack he had been flying solo. His instructor had indicated later that "a dual hop should have been flown because of poor visibility that day." He had not used instruments and had not been able to see his usual ground references. The patient had not become disoriented but he had noticed a "foggy feeling." He was able to return to the base by flying through the first break in the clouds. He felt that the conditions the following day were very similar and that it would be "unwise to repeat the experience," so he declined his "hop."

Psychiatric examination revealed that the patient's motivation for flying was marginal and that he obtained minimal pleasure from flying. He had entered flight training as a means of bolstering his inadequate sense of gender role so that he might come to grips with "this hostile world." He was a passive-dependent man who had been reared in a fatherless home where he had been entirely dependent upon his mother. He feared an identification with a phallic mother and denied his identification with his impotent father, whom the mother had divorced. Flying had put the patient into a situation where he felt isolated and helpless when left to his own resources.

In solitary surface travel acute anxiety attacks are not uncommon. A not infrequent example is that of a motorist traveling alone along a monotonous turnpike having little to do but watch his speed limit. This type of driving fosters a sleep state and can precipitate an altered ego state and acute anxiety in individuals susceptible to fantasy elaborations of primary process material. And in the analytic situation, which allows for the return of the repressed, acute anxiety attacks are by no means uncommon. These examples also raise theoretical questions. Are neurophysiological theories[31,53] relating altered sensory input to afferent reduction in the reticular activating system valid for such short-term sensory experiences?[14] Are there individual differences in neural organization that bear on vulnerability to altered sensory input and decrease in vigilance?

The case material presented in this study suggests that the "break-off" phenomenon represents various altered ego states which resemble depersonalization and derealization: estrangement from self or object associated with strong affective and perceptual changes. "Break-off" experiences are the result of alterations in ego function. The effects of solitary flying are phenomenologically similar to those of severe fatigue, hypnogogic states, drug intoxications, and toxic conditions, all of which can result in a diminution in awareness of the environment, an adumbration of ego boundaries, and partial failure of the synthetic function of the ego.[21] Consequent to the relaxation of attention, censorship is suspended allowing expression of fantasies, memory traces, and primitive body image in disguise, formed from various levels of ego development and consciousness. As in hypnosis, a reversible libidinal and topographical regression in the service of the ego occurs.[18]

Tolerance for splitting of the ego varies among individuals. In this study several aviators felt a sense of pleasure which they associated with heightened attention. They were able to relax and enjoy the novelty of the flying situation in a detached self-observational manner. They revelled in feelings of pleasure while at the same time guarding with their observing ego and its effective repertoire of ego defenses against total surrender to the situation. On the other hand, other aviators experienced reduced awareness and distinct displeasure. They ambivalently feared passive surrender to emerging regressive feelings and perceptions. Their ego response to the danger signal of anxiety was ineffectual, leading to increased anxiety and physiological concomitants. These aviators felt the need to join up with another aircraft or terminate the flight. Omnipotence and magic control were shattered. Their loss of self-confidence could be seen as a hunger for objects to strengthen the self. Psychiatric evaluation of the aviators who experienced anxiety with estrangement revealed that they had poorly formed sex-role identities. Their differential identifications with parents had been made on contradictory or inadequate sex-typed models. Furthermore, they rejected dependency strivings which in the flying situation were increased beyond the capacity of ego defenses and led to dissonance between their ideal representation of the self and their actual self. In each case the loss of proper esteem for the self-image was prominent.

The three aviators who poorly tolerated the "break-off" phenomenon were paralyzed by acute anxiety in flying and developed fear of flying reactions.[42] This behavioral pattern is characteristic of a neurotic fear of flying reaction which is typically ushered in by an acute anxiety attack and eventuates in a phobia of flying. Precipitants of such anxiety attacks can be a trivial accident or a chance event connected with flying, which then weakens the aviator's sense of invulnerability. Bond and other investigators have described these patterns in military flying.[6,17,41-43] To these sensory-symbolic precipitants of anxiety in flying should be added the "break-off" phenomenon.

In acute anxiety reactions in flying there occurs a phobic response with concomitant physiological symptoms based on a reactivation through failure of ego defenses of an earlier neurosis involving conflicts of drives, identification, superego imperatives, and ego ideals. A sense of internal fear stemming from a neurotic conflict is displaced to an external object or situation, which is then avoided with partial gain to the ego. Through symbolic substitution anxiety is focused on the aircraft which then becomes the phobogenic object.[11,15] The aircraft is an apt object for displacement of neurotic conflict because of the qualities and symbolism it possesses: a phallic instrument [16] of power and destruction, as well as punishment and retaliation, directly under the control and execution of the aviator in space.

In conclusion, this exploratory study of the "break-off" phenomenon points to the need and opportunity for further research in aviation psychiatry and sensory deprivation, with particular attention to the discrimination of individual vulnerability to aviation stresses.[44] Research efforts in aviation psychiatry should be more directed to studies in psychoanalytic ego psychology, including the conflict-free areas of ego function such as cognition and perception.[10,35,50] The practical application of this research to supersonic passenger transport, as well as future space exploration, is obvious. Supersonic passenger transport travel (SST) will result in travel fatigue through increased restriction from seat belt wearing and abrupt changes in clock time. Take-offs and landings (seat-belt time) will be longer in SST travel. The cabin staff will be less able to interact with passengers during seat-belt time because of restrictions imposed upon them by acceleration and steep floor angles. Consequently, SST passengers may be exposed to greater flying stresses increasing the likelihood of neurotic travel sickness in predisposed passengers. It can, therefore, be anticipated that psychiatrists will encounter more clinical problems related to flying in their everyday diagnostic and therapeutic work.

Summary

The "break-off" phenomenon, a feeling of physical separation from the earth experienced by jet aviators flying alone at high altitudes and relatively unoccupied with flying details, has been well described. Several studies have suggested that the "break-off" phenomenon is related to the

personality of the aviator and is most apt to occur in emotionally unstable aviators. The present report is an exploratory study which aims at an assessment of "break-off" experiences in aviators who demonstrate, on psychiatric examination, signs and symptoms of a psychiatric disorder.

It is postulated than the "break-off" phenomenon can precipitate an acute anxiety attack with phobic and psychophysiological manifestations and lead to the development of a fear of flying reaction. As a corollary, it is also postulated that the phenomenon occurs most often in jet aviators with emotional and personality disorders. In addition, the "break-off" phenomenon is more apt to be reported by more experienced jet aviators who have greater contact with high altitude solitary flying.

During a six-month interval all designated naval and Marine jet aviators referred for neuropsychiatric consultation were questioned in regard to the "break-off" phenomenon. Evaluations were done at the US Naval School of Aviation, Pensacola, Fla, and included open-ended psychiatric interviews, aviation research questionnaires and standard psychological batteries. In this manner 37 jet aviators were evaluated; they could be divided into two groups on the basis of significant psychopathology.

It is found that there is a greater incidence of "break-off" experiences among aviators with positive psychiatric findings. The "break-off" phenomenon is shown to be a precipitant of acute anxiety attacks with phobic and psychophysiological manifestations, which leads to a fear of flying reaction. The third hypothesis is not proved; the "break-off" phenomenon is not necessarily related to greater contact with high altitude solitary flying.

Representative case histories are presented to illustrate the personality and psychodynamic factors thought to be associated with adverse reactions to the "break-off" phenomenon. The mechanisms of phobic anxiety in high altitude solitary flying are discussed. The results of low sensory input studies are reviewed in an attempt to demonstrate that anxiety reactions associated with the "break-off" phenomenon are determined by multiple factors, both intrapsychic and environmental, which warrant more intensive investigation in aviation psychiatry.

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