



AFRL-RH-WP-TR-2024-0021

HISTORY AND DEVELOPMENT OF THE SELF-DESCRIPTION INVENTORY (SDI)

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APRIL 2024
Interim Report

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REPORT DOCUMENTATION PAGE					Form Approved OMB No. 0704-0188	
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1. REPORT DATE (DD-MM-YY) 01-04-24			2. REPORT TYPE Interim		3. DATES COVERED (From - To) January 2024	
4. TITLE AND SUBTITLE History and Development of the Self-Description Inventory (SDI)					5a. CONTRACT NUMBER FA8650-21-F-4104	
					5b. GRANT NUMBER	
					5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Montana R. Drake ^a , Thomas R. Carretta ^b , Amanda N. Mouton ^c , and Andrew R. Deregl ^c					5d. PROJECT NUMBER	
					5e. TASK NUMBER	
					5f. WORK UNIT NUMBER H12Q	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) DCS Corporation ^a 4027 Colonel Glenn Highway, Suite 210 Dayton, OH 45431-1672					8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Materiel Command ^b Air Force Research Laboratory 711 th Human Performance Wing Human Effectiveness Directorate Air and Space Biosciences Division Performance Optimization Branch Wright-Patterson AFB, OH 45433			Air Force Personnel Center ^c Strategic Research and Assessments Branch 550 C Street West, Ste. 10 JBSA – Randolph AFB, TX 78150		10. SPONSORING/MONITORING AGENCY ACRONYM(S) 711 HPW/RHBC	
					11. SPONSORING/MONITORING AGENCY REPORT NUMBER(S) AFRL-RH-WP-TR-2024-0021	
12. DISTRIBUTION/AVAILABILITY STATEMENT Distribution Statement A. Approved for public release. Distribution is unlimited.						
13. SUPPLEMENTARY NOTES Report contains color. AFRL-2024-2052, cleared 16 April 2024.						
14. ABSTRACT The Self-Description Inventory (SDI) has been a United States Air Force (USAF) personality measure from its initial creation to present day. It has gone through many revisions and adaptations since its inception. This report reviews the work that has been completed on the SDI over the years. More specifically, the initial creation of the Air Force SDI (AFSDI) in 1997, the creation of the SDI Plus (SDI+) in 2003, the adaptation of the SDI+ in 2011, and the creation of the SDI for Officers (SDI-O) in 2017. Research prior to 2022 is reviewed and future research efforts (2022 and after) are described.						
15. SUBJECT TERMS Air Force Officer Qualifying Test, AFOQT, Self-Description Inventory – Officers, SDI-O, predictive success models						
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT: SAR	18. NUMBER OF PAGES 26	19a. NAME OF RESPONSIBLE PERSON (Monitor) Thomas Carretta	
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER (Include Area Code) N/A	

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1.0 EXECUTIVE SUMMARY

The Self-Description Inventory (SDI) has been a United States Air Force (USAF) personality measure from its initial creation in 1997 to present day. However, it has gone through many revisions and adaptations since then. This report reviews the work that has been completed on the SDI since its inception. See Table 1 for a broad-level overview of each iteration of the SDI and Figure 1 for a historical timeline view of the changes that have been made to the SDI. The remaining sections review each iteration of the measure in more detail.

Table 1. Overview of Self-Description Inventory History

Component	AFSDI	SDI+	SDI+	SDI-O
Primary Contributor(s), Year	Tupes & Christal (1959); Christal (1997)	Alley (2003)	Manley (2011)	Manley & Weissmuller (2017)
Items	163-items 64 traits, 99 behavioral statements	220 items All behavioral statements	220 items All behavioral statements	240 items All behavioral statements
Items per facet	Variable	Variable	Variable	8
Facets	22	0	20	30
Facets per domain	Variable	Variable	Variable	Variable
Domains	5: Openness Conscientiousness Extraversion Agreeableness Neuroticism	7: Openness Conscientiousness Extraversion Agreeableness Neuroticism Team Orientation Service Orientation	6: Openness Conscientiousness Extraversion Agreeableness Neuroticism Machiavellianism	6: Openness Conscientiousness Extraversion Agreeableness Neuroticism Machiavellianism
AFOQT Form	N/A	Form S	Form S	Form T & Form T v2
Years Implemented	N/A	2005-2011	2011-2015	2015-Present
Rating Scale	7-point from ‘Very Strongly Disagree’ to ‘Very Strongly Agree’ (for behavioral statements) 9-point from ‘Extremely not characteristic of me’ to ‘Extremely characteristic of me’ (for traits)	5-point from ‘Strongly Disagree’ to ‘Strongly Agree’	5-point from ‘Strongly Disagree’ to ‘Strongly Agree’	5-point from ‘Strongly Disagree’ to ‘Strongly Agree’

Note. AFSDI = Air Force Self-Description Inventory. Team Orientation (TO) and Service Orientation (SO) for Alley’s (2003) SDI+ inventory are “synthetic” factors that were rationally created. Manley’s (2011) factor analysis work confirmed SDI+’s structure to reflect 6 factors, with Service Orientation reflecting Machiavellianism.

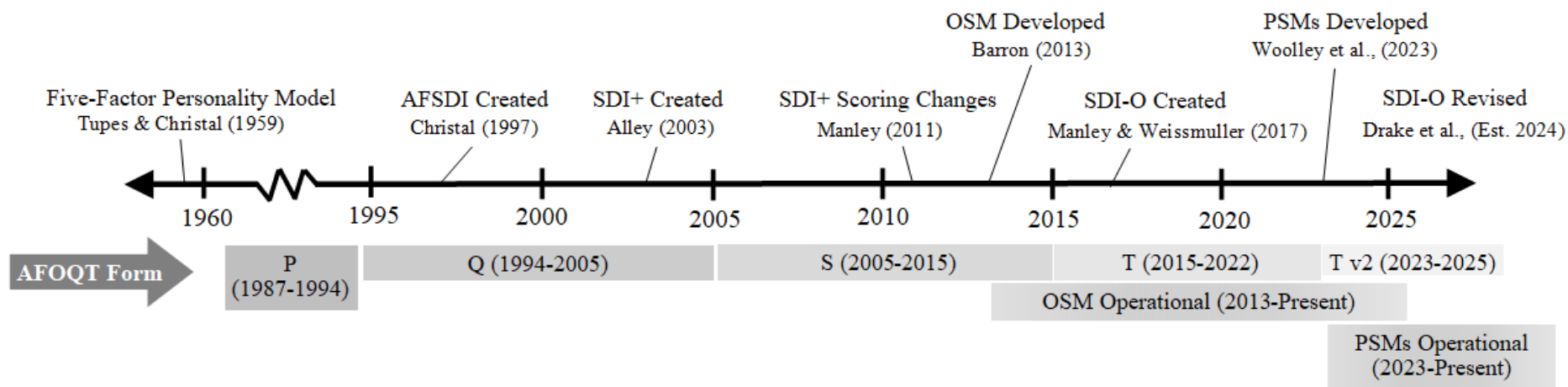


Figure 1. Self-Description Inventory Timeline

Note. The five-factor personality structure was discovered in 1959. This work led to creation of AFSDI in 1997. The first personality measure included as part of the Air Force Officer Qualifying Test (AFOQT) was the SDI+ in Form S (2005). Next iteration (Self-Description Inventory for Officers; SDI-O) was included in Form T. These measures were largely experimental, meaning they did not contribute to composites used for selection and classification, except for the Officer Suitability Measure (OSM) score used in the Officer Training School (OTS) selection board process, beginning in 2013. The Predictive Success Model (PSM) development for AFOQT Form T v2 (2023) is the first-time personality became part of the operational composites.

2.0 PERSONALITY MEASUREMENT IN THE USAF

The use of personality inventories in the USAF dates to the 1940s (e.g., Cattell, 1947). Early personality theories proposed a wide range of personality descriptors with as few as two and as many as 20 different personality dimensions. Tupes and Christal (1958) examined the stability of personality trait ratings under diverse conditions. Tupes and Christal (1961) analyzed the correlations among 35 personality traits that were selected as representative of the personality domain. The study consisted of peer ratings of personality from eight separate samples. Three were from the Air Force Officer Candidate School, one was from the Air Command and Staff School, and four were archival data sets from Cattell's (1947, 1948) and Fiske's work (1949). Using a factor-analytic approach, Tupes and Christal (1961) found five strong and recurrent factors which they labeled as (1) Surgency, (2) Agreeableness, (3) Dependability, (4) Emotional Stability, and (5) Culture.

1. **Surgency (also called Extraversion):** This factor is defined by the primary traits of Talkativeness, Frankness, Adventurousness, Assertiveness, Sociability, Energetic, Composed, Interest in Opposite Sex, and Cheerfulness.
2. **Agreeableness:** This factor is defined by the primary traits of Good-Natured, Not Jealous, Emotionally Mature, Mildness, Cooperativeness, Trustfulness, Adaptability, Kindliness, Attentiveness to People, and Self-Sufficiency.
3. **Dependability (also called Conscientiousness):** This factor is defined by the primary traits of Orderliness, Responsibility, Conscientiousness, Perseverance, and Conventionality.
4. **Emotional Stability (also called Neuroticism):** This factor is defined by the primary traits of Not Neurotic, Placid, Poised, Not Hypochondriacal, Calm, Emotionally Stable, and Self-Sufficient.
5. **Culture (also called Openness to Experience):** This factor is defined by the primary traits of Cultured, Esthetically Fastidious, Imaginative, Socially Polished, and Independent-Minded.

The Tupes and Christal (1961, 1992) study, which provided support for a Big Five personality structure, did not receive wide dissemination. Personality research was largely unsuccessful in academic literature until the 1980s and 1990s, when new statistical procedures (e.g., confirmatory factor analysis, structural equation modeling) allowed researchers to advance the field of personality psychology. Specifically, researchers used a lexical approach and a personality questionnaire approach in tandem with statistical data reduction techniques to unveil what we now call the Five Factor Model (FFM; Costa & McCrae 1990; Goldberg, 1990, 1993; McCrae & Costa, 1987). The FFM, also called the Big Five, is believed to be the underlying structure of the personality hierarchy. Although not without criticism (c.f., Block, 1995; Carlson, 1992; McAdams, 1992; Westen, 1995), the FFM model is now widely accepted as the gold standard in personality trait hierarchies. The Big Five includes the broad traits (also called domains) of Neuroticism (N), Openness (O), Conscientiousness (C), Agreeableness (A), and Extraversion (E), with each consisting of narrower facet traits. The specific facets included within each domain varies slightly between personality models. There are a few popular alternative models which specify six rather than five main factors. For example, (1) a six-factor model called the HEXACO (Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to

Experience; Ashton et al., 2000) which includes the Big Five domains plus Honesty-Humility, and (2) a six-factor model called the Six Factor Personality Questionnaire (6FPQ; Jackson et al., 1996), which includes the Big Five domains of Openness, Extraversion, and Agreeableness, in addition to the domains of Methodicalness, Industriousness, and Independence.

3.0 DEVELOPMENT AND VALIDATION OF THE AFSDI

Development of the AFSDI began in 1959 when Tupes and Christal identified the Big Five factor model of personality. This work was the foundation for the 1997 AFSDI (Christal, Barucki, Driskill, & Collins, 1997) measure, which was intended to capture the Big Five domains for experimental use in the USAF (Skinner et al., 2007). Christal used data from enlisted personnel going through Basic Military Training (BMT) at Lackland Air Force Base. He used factor analysis on over 3,000 responses to develop the initial inventory. The AFSDI was computerized and included items which asked respondents to provide ratings on traits (64 items) and ratings on behavioral statements (99 items; Christal, 1994). Each factor was composed of “subfactors” or facets. The facet structure as proposed by Christal can be seen in Table 2.

Table 2. AFSDI Factor Structure: Dimensions and Underlying Facets

Agreeableness	Conscientiousness	Extraversion	Openness	Emotional Stability
Warm and sympathetic	Efficient and dependable	Shy and bashful	Philosophical	Nervous and stressed out
Friendly	Hard working	Talkative	Scientific interest	Worrying
Considerate	Organized	Socially active	Creative	Irritable
Cold and insensitive		Assertive	Reflective	Envious and jealous
Helpful		Unsociable	Cultured	

The two sections of the AFSDI (traits and behavioral statements) were presented randomly. Responses were on a 7-point scale for traits and 9-point scale for behaviors. See Figure 2 for an example of the trait scale, and Figure 3 for an example of the behavioral scale.

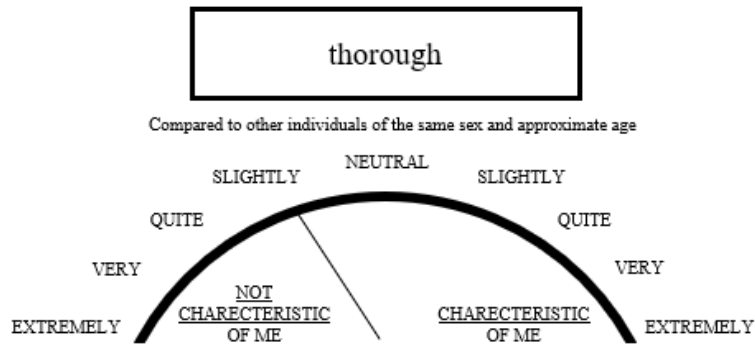


Figure 2: Rating Scale for AFSDI Trait Names

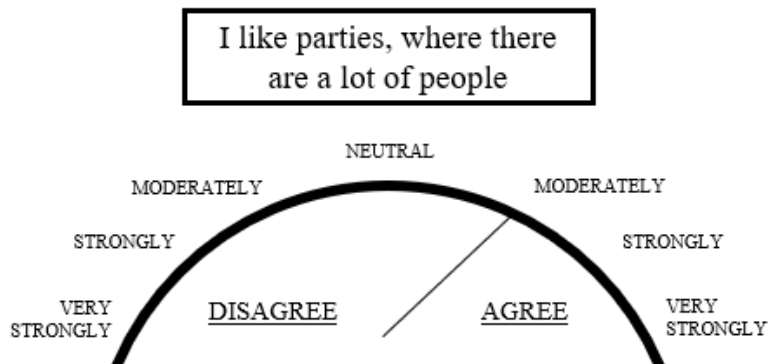


Figure 3. Rating Scale for AFSDI Behavioral Statements

The rating scales recorded 45 different locations along these scales rather than the seven (traits) or nine (behaviors) visually depicted. It should be noted that the traits often needed to be defined due to a lack of understandable vocabulary among subjects.

Collis (1996) performed three additional studies to further evaluate the AFSDI. The first study was a cross-validation of the AFSDI meant to confirm the structure of the inventory. The AFSDI was administered to 573 USAF commissioned officers and officer trainees from four sources: the Air Command and Staff College, Squadron Officer School, the USAF Academy (USAF A), and OTS. The same five-factor structure was derived from items loading at .40 or above. Additionally, the correlation matrices were found to be very similar to the initial enlisted sample used for creation. Subgroup comparisons were also made within the sample. Collis found that females reported themselves as less neurotic than males, and more agreeable, conscientious, and extraverted. Additionally, differences were found between officer commissioning programs, with more experienced officers scoring lower in agreeableness, extraversion, and openness (Collis, 1996).

The second study examined the stability of the AFSDI. Test-retest reliability previously had been assessed using a short interval (24 hours) between testing instances. Reliability was high, with correlations between .88 and .94 (Shute & Gluck, 1995). This second study examined test-retest reliability of the domain-level scores with a longer testing interval. With a one-year test-retest interval, correlations were between .60 and .82. With a two-year testing interval, correlations were between .53 and .72 (Collis, 1996).

The third study examined the equivalence of a paper-and-pencil version of the AFSDI to the computerized version. This version was developed in the United Kingdom and called the Trait Self-Description Inventory (T-SDI; Collins, 1995). It used a 7-point scale for behavioral statements and a 9-point scale for traits. A similar five-factor structure was found with the paper and pencil test version (Collis, 1996).

Information regarding the items included in the AFSDI, as well as the calculation of factor and facet scales, and the items that were retained for the SDI+ is available on request from the Air Force Personnel Center, Strategic Research and Assessment Branch (AFPC/DSYX).

4.0 DEVELOPMENT AND VALIDATION OF THE SDI+

4.1 Development of Original SDI+

As part of a multi-year contract between the Air Force Personnel Center (AFPC) and Operational Technologies Corporation (OpTech), Alley (2003) identified 10 noncognitive constructs to consider for inclusion in future versions of the AFOQT including: Management Decision, Conscientiousness/Integrity, Team Functions/Team Orientation, Organizational Commitment/Service Orientation, Reaction to Stress, Motivation to Fly, Impulsiveness, Competitiveness vs. Cooperation, Motivation to Manage, and Social Skills. Two of these 10 constructs were selected to supplement the Big Five domain content: Service Orientation (SO) and Team Orientation (TO).

SO was meant to assess an officer applicant's potential for organizational commitment. This included items meant to identify those more inclined towards self-sacrifice for the good of the organization as opposed to those inclined towards more egocentric behaviors (Alley, 2003). TO was designed to assess predispositions for working comfortably in a group as opposed to those who prefer to work alone.

Alley (2002) converted the trait descriptors used in the AFSDI to behavioral statements. This was due to the ambiguity of trait definitions, as well as to improve simplicity and have the same rating format throughout the measure. Next, 80 new items were written to measure SO and TO. The rating scale was changed to a 5-point scale ranging from Strongly Disagree to Strongly Agree.

These items were assembled into booklets and administered over a period of four months to approximately 600 USAF enlistees attending BMT. Items were scored and factor-analyzed using orthogonal rotation. Five, six, and seven factor solutions were examined and compared. In the five-factor solution, the expected Big Five factors emerged. In the six and seven factor solutions, a

separate factor was extracted which loaded heavily with SO. However, in the seven-factor solution, a clear TO factor did not emerge, so items from Conscientiousness, Agreeableness, and Extraversion factors were used in combination with unique TO-related items (Alley, 2003). After review of the results, 19 items from SO and 15 items from TO were removed. This resulted in a 220-item measure for the final SDI+. See Table 3 for the number of items and factor definitions on the SDI+.

Table 3. 2002 SDI+ Factors and Items

Factor Name (Code)	Number of Items	Definition
Service Orientation (SO)	21	Willingness to put aside personal interests for the overall benefit of the organization
Team Orientation (TO)	25 (+17)*	Preferences and capacities for working in team environments vs. working alone
Conscientiousness (C)	37	Predisposition for orderliness and task completion
Agreeableness (A)	38	Tendency to be friendly and accommodating in social situations
Neuroticism (N)	38	Anxiety and concern over personal health and social status
Openness (O)	29	Openness to new experiences and cultural exposure
Extraversion (E)	32	Tendency to be outgoing and sociable vs. withdrawn

Note. *Team Orientation is calculated with 25 items unique to Team Orientation, and additional 17 items which loaded on both TO and another factor (C, A, or E).

After enough data had been collected on the SDI+, Halper et al. (2010) performed an exploratory factor analysis (EFA) and discovered a 26-factor solution rather than the 7-factor solution originally intended. Some of these factors included subfactors as well. See Table 4 for a description of all 26 factors and subfactors. The varimax-rotated EFA originally revealed 29 factors, but after grouping factors by their highest loadings, only 26 factors remained (excluding factors 23, 28, and 29). Despite these findings, no changes were made to the SDI+ or calculation of facets or domains at this time.

Table 4. Halper et al. (2010) Factor and Facet Definitions

Factor/Facet	Name	Definition
Factor 1	Agreeableness	The kinds of interactions an individual prefers ranging from compassion to antagonism
Facet 1A	Sociability	Tendency to interact with others in an agreeable manner
Facet 1B	Tender mindedness	Tendency to treat others with kindness and consideration
Facet 1C	Altruism	Active concern for the welfare of others
Facet 1D	Insensitivity	Deficient in concern for others' feelings
Facet 1E	Intrapersonal Awareness	Recognition of emotional impact on decision-making
Factor 2	Conscientiousness	Degree of organization, persistence, control, and motivation in goal directed behavior
Facet 2A	Self-Discipline	Capacity to begin tasks and follow through to completion despite boredom or distractions
Facet 2B	Responsibility	Ability to be reliable and dependable
Facet 2C	Competence/Deliberation	Belief in own self-efficacy/ tendency to think things through before acting or speaking
Facet 2D	Timeliness	Ability to meet deadlines
Factor 3	Extraversion	Quantity and intensity of energy directed outwards into the social world
Facet 3A	Unassertiveness	Lacking social ascendancy and forcefulness of expression
Facet 3B	Warmth	Interest in and friendliness towards others
Facet 3C	Excitement Seeking	Need for environmental stimulation
Facet 3D	Non-gregariousness	Lack of preference for the company of others
Factor 4	Neuroticism	Individuals prone to psychological distress and have difficulty in tolerating frustration
Facet 4A	Expectation Violation	Changes in disposition when situations do not go as planned
Facet 4B	Vulnerability	General susceptibility to stress, especially in pressure situations
Facet 4C	Anxiety	Level of free-floating distress or uneasiness without direct cause
Facet 4D	Depression	Tendency to experience feelings of guilt, sadness, despondency, and loneliness
Factor 5	Openness to Experience	The active seeking and appreciation of experiences for their own sake
Facet 5A	Feelings	Openness to inner feelings and emotions
Facet 5B	Contemplative	Tendency to think things through thoroughly
Factor 6	Service Orientation	Providing help and support for the good of the group
Facet 6A	Hyper-competitiveness	Being very competitive in nature without concern for others
Facet 6B	Self-serving	Being more occupied with one's own interests than others' interests
Factor 7	Order	Personal organization
Factor 8	Ideas	Intellectual curiosity
Factor 9	Teamwork	Ability to work with others to reach a common goal
Facet 9A	Performance in a Group	Ability to work productively with others
Facet 9B	Working in Isolation	The need to work alone
Factor 10	Envy	Resentment towards another person due to their success or achievements
Factor 11	Vanity	Displaying tendencies of over-the-top confidence in oneself
Factor 12	Worry of the Future	Concern for things that have not yet happened
Factor 13	Helpfulness	Tendency to assist others when they are in need
Factor 14	Innovation	Ability to come up with new concepts and ideas
Factor 15	Aesthetics	Appreciation of art and beauty
Factor 16	Defensive	Guarding against the potential of threat to oneself (ego, criticisms, etc.)
Factor 17	Self-perception	How a person perceives them self
Facet 17A	External Attribution	Blaming others for any wrong that occurs
Facet 17B	Egotistical	Belief that oneself is the most important person
Factor 18	Social Isolation	Lack of interaction with others in social settings
Factor 19	Social Openness	Tendency to accept situations with more people present than anticipated
Factor 20	Job Success	Attitudes toward performance as related to the workplace
Factor 21	Intellectual Superiority	Idea that other people are inferior in mental ability
Factor 22	Leadership	Ability to direct and guide others
Facet 22A	Leader Emergence	Tendency for a person to take the lead position
Facet 22B	Collaboration	Ability to fuse ideas with others
Factor 24	Freedom	Belief that people are able to do things and act as they please within legal limits
Factor 25	Competitive Nature	An individual's desire to win/outperform others
Factor 26	Positive Emotion	Tendency to experience cheerful or joyful emotion

Factor 27	Conventional Reasoning	Tendency to comply with current rules, customs, norms, and expectations
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4.2 Changes to the SDI+

Manley (2011) set out to develop facet-level measures using the 220 item SDI+. Data included approximately 60,000 responses on the AFOQT Form S collected from July 2005 to June 2011. A correlation matrix was used as the input for a principle factor analysis (PFA) with varimax (i.e., orthogonal) rotation. Orthogonal rotation does not allow for correlations between factors but enables factors to be spread further apart so they are more easily identifiable. Based on the heuristic of an Eigenvalue of 1.0, PFA analysis suggested the presence of 29 factors while the scree plot elbow heuristic suggested between five and seven factors. The goal of these analyses was to identify broad factors, so the scree plot was used. A six-factor solution was the best and most interpretable solution, showing the Big Five and a sixth factor reflecting Machiavellianism. This six-factor solution utilized 180 of the 220 items, using a loading cutoff of .37.

Next, each of the domain-level factors were analyzed to identify subfactors (or facets). Subsequently, 20 facets were identified using 178 of the items. Items were required to have a loading of at least .40 to be included in a facet measure. Facet names and definitions came from three sources: the NEO Personality Inventory– Revised (NEO-PI-R) taxonomy (Costa & McCrae, 1992), the previous factor analysis (Halper et al., 2010) detailed in Table 3, and the dictionary. See Table 5 for all domain and facet names and the number of items utilized to measure each. See Table 6 for domain and facet definitions and internal consistency reliability (alpha or *a*) values. All measures were found to have acceptable internal consistency (Manley, 2011).

Table 5. 2011 SDI+ Domains, Facets, and Number of Items

Domain Name	Facet Name	Number of Items
Agreeableness		53
Neuroticism		34
Extraversion		31
Conscientiousness		30
Openness		23
Machiavellianism		9
Agreeableness	Team Player	12
	Pleasant	13
	Considerate	9
	Helpful-Altruistic	10
	Hyper-Competitive	7
Neuroticism	Stress Under Pressure	19
	Temperamental	11
	Worry	5
Extraversion	Unassertive	18
	Sociable	10
	Dominance	4
Conscientiousness	Achievement Striving	22
	Order	7
Openness	Creative	6
	Reflective	8
	Scientific Interest	5
	Cultured	2
Machiavellianism	Envious	3
	Individualistic	4
	Self-serving	3

Table 6. SDI-O Domain and Facet Definitions

DOMAINS & FACETS	Facet #	<i>a</i>	DEFINITION
A - Agreeableness	-	.96	The kinds of interactions on individual prefers ranging from compassion to antagonism
Team Player	F01	.85	Being a dependable and responsible team member
Pleasant	F07	.90	Tendency to be in a pleasant mood, act friendly and get along well with others
Helpful-Altruistic	F13	.89	Tendency to be helpful and generous to others with time and effort
Optimist	F25	.88	Having a happy, hopeful, and encouraging outlook on life and the future
Well-Adjusted	F29	.86	Enjoy being around upbeat people while engaging in well-adjusted behavior with laughter, honesty, and dependability
N - Neuroticism	-	.95	The chronic level of emotional adjustment and instability
Stress-Under-Pressure	F02	.86	Tendency to experience stress and discouragement when faced with high-pressure situations
Temperamental	F08	.88	Gets easily upset over events; can be irritable and sensitive to criticism
Worry	F14	.92	Worry a great deal over many things, including what the future holds and how things might go wrong
Angry-Hostility	F20	.91	React with anger and hostility to many stimuli, are easily upset and have short tempers
E - Extraversion	-	.93	The quantity and intensity of preferred interpersonal interactions, activity level, need for stimulation, and capacity for joy
Reserved (R)	F03	.91	Are typically shy and reserved in social situation' often quite and withdrawn
Dominance-Leader	F09	.89	Tend to take charge in group settings, dominate conversations and viewed as a leader
Excitement-Seeking	F15	.92	Enjoy excitement and tend to seek out Stimulating situations
High-Intensity Pleasure	F21	.90	Have a preference for environments with high intensity stimulation such as loud noises and bright lights
Activity	F28	.81	Prefer to stay active much of the time, have a wide range of activities and enjoy multitasking
Spontaneous-Variety	F27	.80	Frequently engage in unplanned and spontaneous activities
C - Conscientiousness	-	.96	The degree of organization, persistence, control, and motivation in goal-directed behavior
Achievement-Striving	F04	.87	Usually engaged in goal-directed behavior and striving to achieve
Order	F10	.91	Are neat and organized with a strong preference for environments with orderly arrangement

Self-Discipline	F16	.88	Focused and dedicated to working hard and completing the task at hand in a timely manner
Deliberation	F22	.90	Carefully think through details of a plan and consequences of behavior before acting
Unconventional (R)	F26	.85	Not strictly bound to following rules, especially if they do not make sense in a given situation
O - Openness	-	.92	The active seeking and appreciation of experiences for one's own sake
Creative	F05	.87	Having the ability to arrive at many novel and innovative solutions to ill-defined problems
Reflective	F11	.83	Propensity to engage in deep reflective thought and meditation; in tune with inner feelings
Scientific Interest	F17	.93	Being highly interested in all topics of science and technology
Cultured	F23	.91	Valuing artistic expression and performance such as art museums, theater, and dance
Imagination	F30	.86	Having an active and vivid imagination, often resulting in daydreaming and fantasy
M Machiavellianism	-	.91	The level in which one engages in deceit, craftiness, and duplicity to expedited control
Interpersonal Tactics	F06	.86	Employing manipulative and exploitive tactics with others as a means for achieving desired ends
Cynical View	F12	.86	Possessing a cynical and negative view of human nature, emphasized with lack of trust
Envious	F18	.91	Often experiences envious and resentful emotions concerning what others have
Influence Tactics	F24	.82	Employing charm and persuasive tactics with others to gain compliance
Independent	F19	.84	Having a preference to work alone on tasks and problems because others are seen as obstacles to accomplishment

4.3 The Officer Suitability Measure (OSM)

The OSM was developed by Barron (2013) for use as part of the USAF OTS officer commissioning process. It was originally based on 20 facets from the SDI+ (Christal, 1994; Manley 2011) which was included in AFOQT Form S beginning in 2005.

The original OSM composite was created by evaluating the relations of SDI+ facets to Basic Officer Training (BOT) completion/attrition. Facets that were significantly correlated with BOT completion were unit-weighted and utilized to predict Order of Merit criteria and Final Training Performance Report scores. Findings showed that the OSM provided significant incremental validity over the AFOQT cognitive ability measures (2.4-3.4 percent (%); Barron, 2013). Cross-validation of the OSM was completed using USAFA Military Performance Averages. Once again, the OSM showed significant incremental validity beyond current AFOQT cognitive selection measures (1.3-1.7%; Barron, 2013). The original OSM composite was comprised of five unit-weighted SDI+ facets. Two facets, A1 Team Player and E3 Dominance, contributed positively toward the final OSM score (i.e., higher scores on these facets increased OSM score) and three facets, A5 Hyper-Competitive, N1 Stress Under Pressure, and E1 Unassertive, contributed negatively toward the final OSM score (i.e., high scores on these facets decreased OSM score). In other words, demonstrating strong teamwork ability and social influence are important for officership success, but being highly unassertive, overly competitive, and susceptible to stress in high pressure situations are indicative of lower officership success. This OSM composite was used in AFOQT Form S until the rollout of the new SDI-O in AFOQT Form T. See section 1.5.1 for information on the updated OSM composite for AFOQT Form T.

5.0 INITIAL DEVELOPMENT OF THE SDI-O

With the implementation of AFOQT Form T in 2015, the SDI+ was reevaluated and revised to reflect missing facets in its existing model of the Big Five, as well as balance the facet-to-domain ratio across domains and balance the item-to-facet ratio. This new version of the SDI+ was named the SDI-O (SDI for Officers; Manley & Weissmuller, 2017).

Manley and Weissmuller (2017) attenuated the length of the SDI+ by removing unnecessary items on 11 scales that were considered robust (i.e., keeping only the eight highest loading items). The remaining nine scales were deemed to be of poor quality and were augmented with additional newly written items. The addition of 15 new facets was also explored.

In the first phase of data collection, three times the number of items required were written. After data collection concluded, two separate EFAs were performed and based on psychometric analyses, the best 67% of the items were retained. In the second phase of data collection, another EFA was performed and the best 50% of the items were retained based on strong factor loadings and weak cross-loadings. The final measure consisted of 30 facets with eight items per facet. The 30 facets were intended to measure six rationally derived personality domains: the Big Five and Machiavellianism.

To test the domain structure empirically and develop sample norms, Manley and Weissmuller (2017) utilized data collected from the SDI-O's implementation in August 2014 to January 2016. EFA results showed that, overall, the facets conformed well to the rational blueprint. The facet-to-domain linkages for Conscientiousness, Agreeableness, and Openness matched perfectly. Additionally, both the Neuroticism and Extraversion factors matched very closely to the rational blueprint, with one exception each. The Machiavellianism facets Envy and Influence Tactics loaded more strongly on Neuroticism and Extraversion, respectively, than they did on Machiavellianism. It should be noted that some facets cross-loaded, but the strongest loading was used for facet-to-domain linkages. Despite the empirical findings, domain scores were still calculated using the rational facet-to-domain linkages.

Prior to the implementation of AFOQT Form T Version 2, the SDI-O facet and domain scores were not used in any of the operational composites. However, Woolley, Walsh, Carretta, Mouton, and Dereglia (2023) examined the utility of the SDI-O facets to maintain/improve the predictive validity of the AFOQT cognitive-based Pilot, Combat Systems Officer, and Air Battle Manager composites while simultaneously decreasing mean score subgroup differences. The addition of the SDI-O facets to the cognitive composites provided modest increases to predictive validity, but mixed results for improving qualification rates for females and minorities. The new composites were implemented in Form T Version 2 as alternates to the AFOQT cognitive-only composites. See Table 6 for all final facets and the facet-to-domain linkages for the SDI-O. A crosswalk of the SDI+ items and which were retained for the SDI-O is available from AFPC/DSYX on request

5.1 The OSM for the SDI-O

As previously described, the OSM was developed by Barron (2013) for use as part of the OTS officer commissioning process. However, not all facets and items used in the original OSM composite were retained in AFOQT Form T. Therefore, a comparable OSM score was created using items from the SDI-O. Then the original (SDI+ based) OSM composite and new (SDI-O based) OSM composite were equated (Barron, 2014). Three facets previously included on SDI+, Team Player, (12-items), Stress Under Pressure (19-items) and Unassertive (18-items), were retained for the SDI-O, but the measures were shortened to 8-items per facet. Meanwhile, items designed to assess Dominance were substantially modified and item content assessing Hyper-Competitiveness was removed entirely from the SDI-O. Therefore, for OSM composite calculation, new Dominance and Hyper-Competitiveness facet measures were created using items from the SDI-O. Dominance was replicated using three items from F09 Dominance-Leader (items 184, 244, and 304) and two items from F24 Influence Tactics (items 319 and 379). Hyper-Competitive was replicated using four items from F06 Interpersonal Tactics (items 241, 271, 301, and 331), and one item from F24 Influence Tactics (349). These new facets were found to be equitable and comprise the AFOQT Form T unit-weighted OSM composite (Barron, 2014).

Woolley, Carretta, Mouton, and Dereglia (2023) revalidated the OSM composite developed by Barron (2013) using three different Air Force samples (one OTS and two Reserved Officer Training Corps [ROTC] samples). Using Barron's (2013) original methodology with OTS data, they also explored four alternative composites. These composites were developed to predict overall success in OTS, leadership performance, academic performance, and the combination of these three criteria. These SDI-O based composites were cross-validated in the ROTC samples. Results

indicated the OSM was a moderate predictor of leadership ability in OTS and provided incremental validity beyond the AFOQT Academic Aptitude composite. Although the alternative personality-based composites were stronger predictors of specific OTS training criteria, the OSM score remains the best predictor of success in ROTC training.

6.0 PREVIOUS RESEARCH ON THE SDI

As previously discussed, Barron (2013) explored the criterion-related validity of the OSM composite, but the predictive validity of personality in the USAF using various versions of the SDI has also been explored in several other studies. The studies described below focus specifically on the SDI, although there are additional studies, both within civilian and military literature, which explore personality as a predictor of important workplace outcomes. A thorough review of this additional literature was not within the scope of this project.

Anesgart and Callister (2001) and Alley (2003) found that Air Force pilot training completion was related to Neuroticism and Extraversion. Candidates that were high on Neuroticism and low on Extraversion were more likely to self-eliminate from training than their counterparts.

Maury, Stone, and Carretta (2010) examined the SDI+ in relation to retention in the USAF. Neuroticism, Openness, and Extraversion were each significantly related to retention decisions, albeit weakly. Those who chose to remain in the USAF were more emotionally stable, less extraverted, and less open than those who chose to separate. They also examined whether the SDI+ would explain variance in retention decisions beyond that of biodata measures and found very small levels of incremental validity.

Carretta (2011) examined the utility of the SDI+ domain-level scores for predicting pilot training performance, where the Pilot Candidate Selection Method (PCSM) was used as a baseline. Only Openness demonstrated incremental validity ($\Delta R^2 = .021, p < .01$) to the PCSM composite for predicting Specialized Undergraduate Pilot Training T-6 completion (graduation or elimination). Additionally, Extraversion provided incremental validity to the predictiveness of academic average, Openness and Service Orientation improved prediction of the daily flying average, and Openness added to the predictiveness of T-6 average.

Darr (2011) performed a meta-analysis of the validity of the AFSDI. Effects based on the AFSDI were gathered from 20 military samples ($k = 117, N = 34,217$). This meta-analysis examined the relationship between the Big Five and any other work-related outcomes. Significant effects had correlation strengths ranging from .01 to .35. Although many relationships discovered replicated those found in civilian literature (e.g., Barrick et al., 2001), several relationships were different than expected, suggesting military context may moderate outcomes.

Bleckley (2013) examined the SDI+ (with Big 5 and SO and TO factors) as a potential measure to be used in selection procedures for Air Traffic Controllers (ATCs). Using a sample of 867 ATCs, Bleckley found that 17 items had poor factor loadings ($< \pm .30$), but when removing those items and restricting cross-loadings, seven factors emerged. Additionally, factor inter-correlations were like that of another five-factor model. Next, Bleckley tested the convergent

validity of the SDI+ with the Goldberg Adjective Checklist (another five-factor model measure) using a sample of 1,339 ATC trainees and found tau-equivalence. Therefore, convergent validity was found.

Barron et al. (2016) examined the utility of both AFOQT cognitive measures and the SDI+ domains in predicting officer performance ratings for manned and Remotely-Piloted Aircraft (RPA) pilots. They found that conscientiousness (+) and neuroticism (-) both predicted post training officer stratification for both manned and RPA pilots.

Manley et al. (2017) examined the validity for AFOQT cognitive measures and the SDI+ to predict final grades in cyberspace options and cyberspace control school. They found that three of the six domain scores were significantly correlated with final grades. Neuroticism ($r = -.21, p < .001$) and Conscientiousness ($r = .19, p < .001$) were the two best domain predictors, with Agreeableness also significantly predicting final grades ($r = .12, p < .05$). Additionally, Extraversion and Openness showed evidence of nonlinear relationships with final grades. Of the 20 facet measures, eight displayed significant linear relationships with final school grades, including: Team Player (+), Hyper-Competitive (-), Stress Under Pressure (-), Temperamental (-), Worry (-), Dominance (+), Achievement Striving (+), and Creative (+).

Kantrowitz et al., (2019) performed a comprehensive review of the Tailored Adaptive Personality Assessment System (TAPAS), the Navy Computerized Adaptive Personality Scales (NCAPS) and the SDI. This review included a convergent validation study, which mapped the three measures to each other and examined correlations between mapped facets. They found a high degree of convergence between the measures, and the SDI and NCAPS included measures that were not covered by the TAPAS. The authors also evaluated the TAPAS, NCAPS, and SDI for criterion-related validity and found that the SDI+ explained more variance in six self-rated performance areas when compared to the TAPAS and NCAPS. Next, the authors found that in an honest versus a fake-good condition, the TAPAS was less susceptible to faking than the NCAPS or SDI. Finally internal consistency reliability was lowest for the TAPAS, and only very small differences were found between subgroups on all three measures.

Finally, as part of the AFOQT Form T evaluation, Kantrowitz et al., (2022) (1) explored the potential to utilize SDI-O facets as part of the composite scores used on the AFOQT, (2) mapped the facets on the SDI-O to knowledge, skills, abilities, and other characteristics (KSAOs) discovered via a job analysis of pilots and Combat Systems Officers, and (3) examined the facets in relation to attrition from training. Ten of the facets were utilized in the composite scores, all facets except High Intensity Pleasure mapped to the job analysis, and seven were significantly related to attrition.

7.0 FUTURE RESEARCH EFFORTS

Additional research efforts were part of a contract established in July 2021. The Air Force Research Laboratory (AFRL) developed the contract to support the research goals, objectives, and priorities associated with the 711th Human Performance Wing (HPW) Enhanced Airman Alignment (EAA) Program. The EAA program is focused on improving warfighter performance

through the development of enhanced personnel measurement, selection, and classification methods. Technical problems to be solved/capability to be pursued align directly with optimizing the use of human capital.

More specifically, these additional research efforts include:

- (1) a review of the psychometric analyses performed on the SDI+, using data gathered from August 2005 to May 2015 (Mann et al., 2023);
- (2) a comprehensive analysis of the SDI-O psychometric properties using data collected from August 2016 to September 2020 (Woolley et al., 2022);
- (3) standardized scores for both the SDI+ and SDI-O, an examination of differences among subgroup scores on the SDI-O, and an equating effort to linearly compare the SDI+ to the SDI-O (Drake et al., 2024);
- (4) the previously described effort to develop new PSMs for rated career fields (Woolley, Walsh, et al., 2023); and,
- (5) the previously described effort to revalidate the OSM composite (Woolley, Carretta, et al., 2023).

Finally, based on psychometric analyses of the SDI-O, it is being revised following the recommendations laid out in Woolley et al., 2022. The SDI-O revision is expected to be completed in 2024.

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LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

<	Less Than
α	Alpha (internal consistency reliability)
%	Percent
A	Agreeableness
AFOQT	Air Force Officer Qualifying Test
AFPC	Air Force Personnel Center
AFSDI	Air Force Self-Description Inventory
ATC	Air Traffic Control
BMT	Basic Military Training
BOT	Basic Officer Training
C	Conscientiousness
E	Extraversion
EAA	Enhanced Airman Alignment
EFA	Exploratory factor analysis
FFM	Five Factor Model
N	Neuroticism
NCAPS	Navy Computerized Adaptive Personality Scales
O'	Openness to Experience
OSM	Officer Suitability Measure
OTS	Officer Training School
p	Probability
PCSM	Pilot Candidate Selection Method
PFA	Principle Factor Analysis
PSM	Predictive Success Model
r	Correlation
ROTC	Reserve Officer Training Corps
RPA	Remotely-Piloted Aircraft

SDI	Self-Description Inventory
SDI+	Self-Description Inventory Plus
SDI-O	Self-Description Inventory for Officers
SO	Service Orientation
TAPAS	Tailored Adaptive Personality Assessment System
TO	Team Orientation
USAF	United States Air Force
USAFA	United States Air Force Academy